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13. ABSTRACT (Maximum 200 Words)

This historical study of the nature of war syndromes investigates their essential characteristics by use of war pension files. It looks at randomly-selected populations of UK servicemen drawn from the Boer War, World War One, World War Two, Korea, Malaya and the Persian Gulf War. The diagnoses studied include: DAH, effort syndrome, rheumatism, neurasthenia, shell shock, dyspepsia, psychoneurosis and Gulf-related illness. These war syndromes are related to nature of recruit, rank, type of unit, exposure to combat and other traumatic experiences and to military conduct. Veterans' health records were examined to discover whether war syndromes were related to wounds or other forms of illness acquired during service. In addition, servicemen's attributions are also explored in relation to prevailing health beliefs and advances in medical science. A mortality and morbidity study of randomly selected veterans of World War One compared a sample suffering from DAH and a sample diagnosed with neurasthenia/shell shock with ex-servicemen awarded a pension for minor gunshot wounds. The controls were matched by rank, level of disability and region of the UK.

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Abbreviations used in text

BEF	British Expeditionary Force
DAH	Disordered Action of the Heart
DSS	Department of Social Security
GSW	Gunshot wound
GVMAP	Gulf Veterans Medical Assessment Programme
NCO	Non Commissioned Officer
PRO	Public Record Office, Kew, London
RAF	Royal Air Force
VDH	Valvular Disease of the Heart

Introduction

This final report summarises the research project into war syndromes from 1900 undertaken from 9 March 1998 to 8 February 2001. It was designed to answer two questions:

1. Whether medically unexplained symptoms experienced by soldiers after combat (war syndromes) are similar across the century.
2. Whether the morbidity and mortality rates of servicemen with war syndromes are greater than a control population of veterans with equivalent levels of physical disability.

To answer the first question, it was proposed to compare the symptom patterns of a random sample of 200 servicemen who had served in the Boer War and had been diagnosed as suffering from Disordered Action of the Heart (DAH) with a group of 200 DAH patients from the First World War, 200 Effort Syndrome patients from the Second World War and 200 veterans with functional disorders from the Korean War. These would then be contrasted with a random sample of 400 veterans who had served in the Gulf War and suffered from Gulf-related illnesses.

To answer the second question, it was proposed to compare 700 servicemen with DAH from the First World War with 700 single-limb amputees matched to a similar level of disability. The death certificates of all 1,400 veterans would allow a comparison of their morbidity and mortality rates.

The first two years of the project were allocated for the identification of records, negotiations to obtain access and the extraction of data. The third year was for the analysis of the database and interpretation of results.

BODY

Contributors

The initial study was designed by Ian Palmer and Simon Wessely. Further archival research led to modifications by Edgar Jones, who undertook a pilot study, together with other changes by Simon Wessely and Kenneth C. Hyams. Edgar Jones has been the project manager from the outset and drafted this report. Primary research and analysis of database were undertaken by Charlotte Beech, Robert Hodgins-Vermaas, Helen McCartney and Denise Poynter. Brian Everitt, Professor of Biostatistics at the Institute of Psychiatry, was responsible for the factor and cluster analysis. Colin Chalmers, senior lecturer in statistics at the London School of Economics, was responsible for analysis of the mortality and morbidity study.

Specialist advice was sought in cardiology from Dr Stephen Holmberg and Dr Iqbal Malik, in gastroenterology from Dr Ian Forgacs and Sir Christopher Booth, in radiology from Dr Michele Marshall, Dr Erica Denton and Dr C.N.O'N. Digges, and in medicine from Professor Harry Lee and Dr Roger Gabriel.

The salaried staff were as follows:

Dr Edgar Jones (9 February 1998 to present)

Dr Helen McCartney (9 February 1998 to 31 March 2000)

Denise Poynter (9 February 1998 to 31 December 1999)

Charlotte Beech (1 April 2000 to present)

Robert Hodgins-Vermaas (1 April 2000 to present)

Diane Bunting, part-time secretary and administrator (1 August 1998 to 31 October 2000).

QUESTION ONE: SYMPTOM STUDY

The Identification and Selection of Data

There is no single government repository or public archive that contains the necessary data for this study. War pension files were selected as the primary source because they contain both detailed military and medical reports with repeated investigations. They provide a comprehensive picture of veterans' health sometimes until death.

War Pensions Archive

The pension system for veterans has undergone considerable change from 1900 to the present. During the nineteenth century, other ranks with a disability incurred during active service could apply to the Royal Hospital, Chelsea, for financial compensation. Payments were assessed according to degree of disability (judged by a man's ability to earn a living wage), rank and military conduct. Pensions were usually granted for life and subject to regular medical boards to assess fluctuations in a veteran's health. All the surviving pension files from the Royal Hospital are held at the Public Record Office, London.

The Royal Hospital system was unable to cope with the flood of disability claims that followed mass mobilisation during World War One. In December 1916, the government set up the Ministry of Pensions to take over the existing service and charitable institutions. The Ministry assumed responsibility for the assessment of payments, treatment of veterans and rehabilitation schemes. It changed the

assessment system introducing standardised tables for wounds and loss of function. The Ministry remained the principal government agency until 1966 when war pensions became the responsibility of the Ministry of Social Security (now Department of Social Security). A sample of war pension files from World War One has been deposited at the Public Record Office. Records relating to World War Two and more recent conflicts remain closed to public inspection because many recipients are still alive. It has been necessary therefore to contact a variety of agencies to obtain permission to study comparable records from 1900 to the present.

The Boer War (1899-1902)

The Boers declared war on the British in South Africa on 11 October 1899 to protect the gold-rich Transvaal against incursions by British raiders and to create an Afrikaner republic. The Boer War proved to be the costliest (over £200 million) and bloodiest war (at least 22,000 British troops died) that Britain fought between 1815 and 1914 (Pakenham, 1979). The conflict fell into two distinct campaigns divided by abortive peace talks in February 1901. The first phase involved a series of set battles including Modder River, Colenso, Spion Kop, Paardeberg, Driefontein and the relief of Ladysmith. In the second phase, British forces attempted to establish safe areas first by sweep and scour operations and secondly by enclosing large areas within barbed wire fencing supported by earth and iron blockhouses. The substantial distances covered on foot that these tactics demanded were identified as a potential cause of the many cases of DAH.

The only service files that contain both medical and military records which survive from the Boer War are the pension records of the Royal Hospital, Chelsea. This was a charity established by James II to provide financial assistance for veterans wounded in active service (Dean, 1950). In 1806, its role expanded and pensions were awarded to ex-servicemen who had suffered from disease or who had become exhausted by the accumulated strain of campaigning. All the surviving 6,276 files from the pre-1914 period are held at the Public Record Office, London (Catalogue reference: PIN71). Sadly, the files do not appear to be a complete record of every pension that was awarded by the Royal Hospital. The average ages of the two samples that were randomly selected (68.2 years for DAH and 70.6 years for rheumatism) suggest that the files relate to the longest-lived pensioners. The records of those who died young were probably destroyed by the Ministry of Pensions.

As the Department of Social Security catalogued each file by name of recipient, but not by invaliding diagnosis, it was necessary to survey the entire archive to identify the characteristics of the pre-1914 pension population (Table 1). This information was also needed to guide the selection of a random sample. The extraction of data was a time-consuming process. It was not possible to use random numbers to generate a sample as each pensioner's diagnosis was unknown. This could only be discovered by requesting and searching all 6,276 files. Two samples were obtained by using pensioners' surnames. The total population was arranged in alphabetical order by surname and the proportion calculated for all those whose surname began with an 'A'. The procedure was repeated for every letter of the alphabet and the sample randomly selected according to these percentages to ensure that it was representative. Cases were excluded only if there were insufficient data, if there was evidence of an underlying organic disorder, major mental illness or if a serviceman

had been a prisoner-of-war. A minimum of four symptoms had to be present for a subject to be included in the study.

Table 1 An analysis of the Royal Hospital pension files (1854-1913)

Disorder	Single Diagnosis	Multiple Diagnosis
Disordered Action of the Heart (DAH)	132 (2.1)	199 (2.9)
Valvular Disease of the Heart (VDH)	244 (3.9)	356 (5.1)
Rheumatism	158 (2.5)	272 (3.9)
Debility	89 (1.4)	392 (5.7)
Neurasthenia/ nervous weakness	15 (0.2)	20 (0.3)
Gunshot wounds	2,218 (35.3)	2,268 (32.7)
Other diagnoses	3,064 (48.8)	3,064 (44.2)
Not recorded	356 (5.7%)	356 (5.1%)
Total	6,276 (100)	6,927 (100)

Figures in parentheses indicate percentages

Source: PRO, PIN71/1-6276: War Pension Files from the Royal Hospital, Chelsea.

All the files in PIN71 refer to other ranks as officers invalided from the army as a result of service were able to claim half pay. It was not until the Ministry of Pensions assumed responsibility for their welfare in December 1916 that they too became eligible for war pensions.

As regards diagnosis, it was decided to select Disordered Action of the Heart (DAH) and rheumatism. DAH was the term used by the army for what had earlier been called Palpitation, Irritable Heart, Soldier's Heart and Da Costa's syndrome after the American Civil War (Da Costa, 1871; Hyams, 1996). Some cases of Valvular Disease of the Heart (VDH) were also included in the DAH sample where it was clear from repeated medical investigations and death certificates that there was, in fact, no organic heart disease. Rheumatism was selected for intra-war comparison because cases were numerous and held at the time to be the result of sleeping in cold and damp conditions on the veldt. All rheumatism cases included in the study were without objective signs (joint swelling, deformity or inflammation). Any veterans who subsequently showed symptoms of osteo-arthritis were excluded.

Victorian Campaigns (1854-c.1895)

Whilst surveying the PIN71 archive for Boer War veterans, a number of pensioners were discovered who had served in earlier campaigns. One, for example, had spent six months in the Crimea before being deployed in India to suppress the mutiny of 1857 (PRO, PIN71/2260; Jones & Wessely, 1999). Files that related to Victorian campaigns (notably Afghanistan, Egypt and the Sudan) were collected if they referred to a functional somatic disorder. Twenty-eight in total were found and they fell into two broad diagnostic groups: cardiac (19), which included 'palpitation' and 'irritable heart', and debility (9).

World War One

The only surviving war pension records from World War One are held at the Public Record Office (Catalogue reference: PIN26). The 22,756 pension records that make up the holding are primarily based on the London Region of the Ministry of Pensions. When the decentralised system was set up in May 1919, London Region covered only the capital city but under an inter-war reorganisation took over Eastern Region (formerly based at Cambridge), Southern Region (Reading) and South-Eastern Region (Tunbridge Wells). Hence, London Region became in effect South East England and comprised the counties of Norfolk, Suffolk, Huntingdon, Cambridge, Bedford, Buckingham, Oxford, Middlesex, Essex, Hampshire, Sussex, Surrey and Kent (Rhind, 1919, 307). The sampling exercise was undertaken by War Pensions staff, who probably chose London Region as the largest and most accessible holding. They selected every fiftieth file to create a two per cent sample. On this basis, the 22,756 files were extracted from 1,137,800 records. An official report calculated that by March 1930 1,644,000 pensions or gratuities had been granted to veterans of World War One (Mitchell & Smith, 1931, 315), which suggests that the London Region represented about 60% of the total number of pensions and gratuities awarded for the conflict.

The PIN26 holding is subdivided by groups: army and air force other ranks (1-16,678), navy (16,679-17,163), widows (17,164-19,720), mercantile marine (19,721-19,977), nurses (19,978-20,278), overseas (20,279-21,065) and officers (21,066-22,756). These categories are catalogued by name and diagnosis. The entire catalogue was entered on a database and analysed by disorder (Table 2). This demonstrated that DAH and neurasthenia were commonly identified as pensionable disorders and could be employed in the study.

Table 2 Analysis of World War One Pensions

Disorder	As a single diagnosis	Multiple diagnosis
Gunshot wounds	3644 (16)	4510
DAH	1149 (5)	1561
VDH	299 (1.3)	369
Rheumatism	583 (2.6)	798
Gassed	202 (0.9)	279
Debility	568 (2.5)	992
Neurasthenia	817 (3.6)	1135
Shell Shock	73 (0.3)	100
Anxiety neurosis	38 (0.2)	23
Nervous debility	24 (0.1)	18
Depression	25 (0.1)	21
Manic depressive psychosis	17 (0.07)	16
Schizophrenia	11 (0.05)	10
Psychosis	18 (0.08)	16
Other	15,288 (67.2)	15,288
Total	22,756 (100)	25,136

Figures in parentheses indicate percentages.
Source: Public Record Office, PIN26/1-22,756.

To limit the study to the British army, three of the sub-groups were included: army other ranks, overseas (that is servicemen who emigrated after discharge) and officers. These files were numbered consecutively and two samples of 200 selected for each disorder using a random-number generator. Within PIN26, the proportions of officers to other ranks for both DAH and neurasthenia were calculated and the samples adjusted to reflect this population distribution (Table 3).

Table 3 Distribution by rank in World War One samples

Disorder	PIN 26 archive		Study sample	
	Other Ranks	Officers	Other Ranks	Officers
DAH	1097 (98.1)	21 (1.9)	196 (98)	4 (2)
Neurasthenia	716 (82.8)	149 (17.2)	166 (83)	34 (17)

Figures in parentheses indicate percentages

DAH and neurasthenia (as shell shock was reclassified in 1917) were chosen as the disorders for World War One. DAH provides a direct comparison with one of the Boer War groups, while shell shock/neurasthenia was the novel, war syndrome of World War One. Cases were excluded only if a serviceman was found to be suffering from an organic disorder such as malaria, a major mental illness or served in the RAF (members of the Royal Flying Corps were included). Prisoners-of-war were excluded because of the particular psychological problems they experienced and the nutritional deficits many had suffered during 1918, which plausibly damaged their health.

In 1999, an additional five-months funding was granted to research servicemen subjected to gas attack and nurses who served in France. However, the task of extracting these has proved more complex than envisaged. The PRO catalogue records 309 veterans awarded a war pension for the effects of gas or gas poisoning. A survey of these cases has shown that many showed the symptoms of serious exposure to toxic gases with identifiable damage to lungs, skin and eyes. Soldiers that had minimal exposure and no lasting objective signs and yet suffered from unexplained symptoms were re-categorised as DAH (WIHM, RAMC/2045 Meakins and Walker, 1918, 19-26). It is necessary, therefore, to examine all 309 veterans with a pension for gassing to distinguish the organic cases from the functional ones, and to request large numbers of DAH files to identify those that were gas cases rather than cardiac admissions. This will extend the time required to extract a random sample, though the size of the total DAH population (1,118) will ensure the collection of 200 cases. Currently there are 105 cases entered on the database.

It was also proposed to look at nurses who served with the BEF and who were subsequently diagnosed as suffering from unexplained symptoms. The PIN26 holding includes 301 war pensions awarded to nurses, of whom about 100 had functional disorders. To date, 59 nurses have been studied. They fall into two diagnostic groups (cardiac and neurasthenia) and will therefore provide further comparison with the male samples for World War One. This study, together with the gassed sample, is due to be completed by August 2001.

World War Two

The pension files relating to World War Two and the Korean War are closed to public inspection and are held by the Department of Social Security (DSS). In August 1998, after lengthy negotiations, ministerial permission was obtained to gather data from these records and work began on the selection of cases in November of that year. However, it was soon discovered that the very large archive is not only uncatalogued but also complex.

The files are stored chronologically from the time that they were awarded. They are held at two sites in Lancashire: at Nelson for the earliest cases, most of which are no longer in payment (either because the disability remitted or because the pensioner has died), and at Heywood for later terminated files and those still in payment (Table 4). At both sites, they are further sub-divided between the three services and between officers and other ranks. The other ranks' files at Nelson are divided into two groups: those that applied between 1939 and 1942 and which were assessed on a regional basis (133,500 files), and those that applied between 1942 and 1945 and were assessed centrally (300,000 files). These central files are further divided into two groups: M2 and M6. The M2 series continues chronologically from the old regional centres and covers the years 1943 to 1945. The M6 series was created in 1945 to deal with servicemen released (rather than discharged) from the forces at the end of the war. These soldiers were released rapidly either because of their length of service, because their skills were urgently needed in industry or on compassionate grounds. The M6 series was discontinued in 1950. However, the files that related to awards made between 1943 and 1950 were subject to selective destruction in 1989. All files inactive since 1959 were destroyed until the operation was halted by Parliament. Our survey suggests that the process may not have been as thorough as first thought. In addition, it is estimated that there are a further 550,000 inactive files (mostly related to World War Two) and 335,000 files in payment held at Heywood, which relate to all conflicts from the Second World War to the present. The most recent active files are catalogued by National Insurance number (NINO) and their details recorded on a computer database.

The structure of archive has important implications for the design of the sample as different periods of the war saw different groups of servicemen granted pensions. Awards in the first year, for example, were often to elderly territorials or re-enlisted regulars who found active service too stressful. Before the selection and training of troops became carefully controlled, many conscripts were discharged from the forces because their educational, psychological or physical attributes made them unable to cope with the rigors of training (Slater, 1942). In June 1940, the evacuation of the British Expeditionary Force from Dunkirk saw an increased incidence of psychoneurosis, or as it was described at the time 'acute "shell shock"' (Sargent & Slater, 1940). The Normandy campaign of 1944 saw many seasoned troops break down, some war-weary after earlier combat in Africa and Italy (Jones & Wessely, 2001). Conscripts rushed to France because of the manpower crisis were often given insufficient time to be assimilated into combat units. Exposed to fierce fighting, many broke down and also received disability pensions during 1944-45 (Ahrenfeldt, 1958, 151). The various changes that occurred to the pension population determined by the course of the war have to be reflected in the sample.

Table 4 The distribution of Second World War pensions for psychoneurosis

Files/Archive	Estimated total number of pensions (all diagnoses)	Psychoneurosis sample (number of cases)
Regional (Nelson)	133,500 (12)	24 (12)
Central (Nelson and Heywood)	750,000 (68)	124 (62)
NINO (Heywood)	215,000 (20)	40 (20)
Officers	Not known	12 (6)

Figures in parentheses indicate percentages

Our survey of the DSS archive revealed the full complexity of the holding and the difficulties of extracting a truly random sample. The survey work itself was time consuming but considered vital. Having identified the structure and nature of the DSS archive over a period of three months, files were randomly selected to equate with its proportions (Table 4). This too was a labour-intensive operation requiring the manual inspection of files.

In February 1917, Thomas Lewis had proposed that DAH should be reclassified as effort syndrome since in his view most of the symptoms were 'no more than exaggerated manifestations of healthy responses to effort' (Lewis, 1917, 7). By 1939 the term had become widespread and DAH was no longer employed. Effort syndrome was chosen as the first diagnostic group. Yet such cases proved difficult to find. Following pioneering research by Dr Paul Wood at Mill Hill Hospital the term was discredited in 1941 and its use discouraged by military physicians. Wood had shown that these cardiac cases were functional and reflected established patterns of behaving and thinking within families (Wood, 1941). It was not a disorder exclusive to the armed forces and was driven by heightened emotion. Exhaustive searches found only 67 pensions awarded for effort syndrome. This was, as Maxwell Jones recalled, because physicians and psychiatrists progressively abandoned the diagnosis from 1941 onwards (Jones, 1948, 394).

Psychoneurosis was identified as the second diagnostic group for World War Two. The term neurasthenia had fallen from use and the diagnosis shell shock was prohibited. The majority of psychoneurosis cases were in fact described by military psychiatrists as anxiety states or nervous disorders.

It was apparent, however, that World War Two had witnessed an epidemic of suspected duodenal ulcers. Dyspepsia was the largest single cause of medical invalidity from the British Expeditionary Force in France during 1939-40 (Green & Covell, 1953, 139). A contemporary study by Charles Newman and Reginald Payne, funded by the Leverhulme Trust, investigated 287 hospitalised servicemen and found that 89% were suspected of having a peptic ulcer. It was suggested that many had suffered from ulcer before enlistment and that army food had caused a relapse (Payne & Newman, 1940). Indeed, the incidence of peptic ulcer had risen steadily from 1900 and peaked in the early 1950s (Langman, 1979, 15; Tidy, 1941, 413; Riley, 1942, 485). The focus of health concerns in the UK switched from the heart in World War One to the stomach in World War Two and some described the latter as the 'gut war' (Ahrenfeldt, 1958, 276).

With the diagnosis of duodenal ulcer relying on a range of spurious observations, the barium-meal x-ray offered the only test of any reliability, though it has since been demonstrated that radiologists consistently erred on the side of caution. In 1945, *The Essentials of Modern Surgery* confidently claimed that 'in the hands of a skilled radiologist the examination of the stomach and duodenum by the barium meal technique will yield over 90 percent correct diagnosis' (Handfield Jones & Porrit, 1945, 586). In the early years of the war, the prevalence of dyspepsia was a cause of concern in the British army (*Lancet*, 1941, 453; Graham & Kerr, 1941; Hinds Howell, 1942; Tidy, 1943), and large numbers were invalided with suspected duodenal ulcer in the absence of robust evidence. An article in the *Lancet* for August 1945 observed that 'peptic ulcer is known and feared by the laity as a cause of incapacity and sometimes fatal complications... In gastric disorders, which come short of actual ulceration, army experience has shown that even hospital investigation and the ritual of barium meal examination fix the susceptible soldier's attention increasingly on the stomach and help to perpetuate 'functional' symptoms' ('Doctor-Made', 1945, 240). Non-ulcer dyspepsia was selected as the third disorder because of its incidence and powerful cultural association with World War Two.

In order to assemble a sample of dyspepsia patients, it was necessary to extract a large number of veterans with a war pension for duodenal ulcer as few awards had been made for dyspepsia alone. Closer inspection revealed that a substantial number had repeated barium-meal x-rays with negative findings or conflicting radiological evidence. Cases in which the x-rays gave consistent negative results were included in the study and those with conflicting evidence were re-examined by a consultant radiologist, Dr Michele Marshall, for the purpose of this study. By allowing radiologists and gastroenterologists to inspect the duodenum in detail, modern endoscopy has also improved their ability to interpret x-rays. Adopting a conservative policy, it was concluded with reasonable certainty that in about one-third of suspected duodenal ulcer cases no crater had been present, and they were added to the sample. Following this cautious approach, a sample of 100 pensioners was collected.

Malaya (1948-60) and Korea (1951-53)

Considerable problems were encountered in finding cases of psychoneurosis and dyspepsia from Korea and Malaya. Troops deployed there represented a small proportion of the UK's armed forces, and, though veterans of both campaigns were found, very few had a pension with either diagnosis. In the event, it proved possible to find only 5 cases of dyspepsia and 17 of psychoneurosis. It is possible that very detailed and time-consuming research in the DSS archives may reveal more cases.

Gulf War

Although some pensions have been awarded to veterans of the Gulf War, we were not granted permission to consult current pension files. Nevertheless, it was important to study a group who believed they might have a claim for financial compensation so that they would serve as an appropriate comparison for war pensioners. After negotiation, the Ministry of Defence agreed to allow us access to the records of the Gulf Veterans' Medical Assessment Programme (GVMAP) provided that all cases were anonymised. The GVMAP, founded in June 1993 and currently based at St Thomas's Hospital, London, provides thorough medical investigations of Gulf

veterans (whether serving or discharged) who believe that their health may have been affected by service during the Persian Gulf War of 1991. From their database of 2,162 army personnel, a sample of 400 Gulf veterans were selected using a random number generator. Cases were excluded only if they had an organic disorder, major mental illness or missing information. These were assessed using the same questionnaire as the war pensioners. The GVMAP physicians conducted a detailed examination of servicemen and women and a battery of tests were performed. There are only two areas where the GVMAP records differ from the war pension files: the absence of military conduct sheets and any pension awards.

Table 5 The database: total number of cases by war and diagnosis

War – Disorder	Total	Rejected	Entered
<i>Victorian Campaigns (1854-c.1895)</i>			
1. Palpitation	19	0	19
2. Debility	9	0	9
<i>Boer War (1899-1902)</i>			
1. DAH	228	28	200
2. Rheumatism	219	19	200
<i>First World War (1914-18)</i>			
1. DAH	214	14	200
2. Neurasthenia	221	21	200
3. Gassed	105	0	105
4. Women	59	0	59
<i>Second World War (1939-45)</i>			
1. Effort Syndrome	67	0	67
2. Psychoneurosis	218	18	200
3. Dyspepsia	100	0	100
<i>Malaya (1948-60) and Korea (1951-53)</i>			
1. Psychoneurosis	17	0	17
2. Dyspepsia	5	0	5
<i>Gulf War (1991)</i>			
Gulf-related illness	402	2	400
TOTAL	1,719	102	1,617

In total, there were 1,617 cases used in the study (Table 5).

Design of the Database

To collect data in a standardised manner across different conflicts and disorders, a questionnaire was designed ('Historical Medical Record') to record the following information:

1. Biographical details of the serviceman: date of birth and death (including cause of death), education, family history, occupation before and after service, medical history, smoking and alcohol consumption.
2. Pension award: date, amount, diagnosis with changes, increments and reductions, and reason for ending.

3. Military record: nature of service (regular, conscript, volunteer), unit, rank, date of enlistment, date of discharge, dates of service abroad, time in combat, wounds suffered and any other traumatic experiences.
4. In total 94 symptoms were identified and arranged in the following sub-groups: fatigue, cognition, cardiovascular and respiratory, gastro-intestinal, genito-urinary, central nervous system, locomotor system, eye, ear, nose and throat, skin, psychological state, sleep problems, other features (including temperature, appetite, weight changes and self-inflicted wounds).
5. The results of medical investigations.
6. The explanations of the servicemen themselves are recorded together with the comments of the various physicians who examined them.
7. The soldier's military conduct with a summary of any offences committed.

A database was created in Microsoft Access.

Analysis of the database

The basic statistical analysis was performed using Access and the results are presented in Tables 6 to 18 below. The advanced analysis was undertaken by Brian Everitt, Professor of Biostatistics at the Institute of Psychiatry, London. The findings are discussed below.

Literature Review

The extensive literature on war syndromes has been reviewed and a select bibliography is contained in the references to this report. In addition, the major medical journals (notably the *Lancet*, *British Medical Journal*, *Proceedings of the Royal Society of Medicine* and *Journal of the American Medical Association*) have been searched for the period from the Boer War to the end of the Korean War to find papers relating to the psychology of war and particular war-related disorders. Specialist journals (including *Military Medicine*, *Journal of the Royal Army Medical Corps*, *American Journal of Psychiatry*, *Journal of Mental Science*, *British Journal of Psychiatry* and *Heart*) have been surveyed.

As well as medical papers, historical journals have been reviewed. Official government reports and inquiries have been studied, including the Southborough Report of *The War Office Committee of Enquiry into 'Shell-Shock'*, London: HMSO (1922) and Thomas Lewis *Report upon soldiers returned as cases of Disordered Action of the Heart D.A.H. or valvular disease of the heart (V.D.H.)*, London: Medical Research Committee (1917).

Contextual Archival Research

A considerable amount of background archival research has been undertaken at a variety of locations. A detailed list is included in the Appendix.

FINDINGS

1. Nature of Recruit

The type of serviceman included in the various samples (whether regular, conscript, volunteer, reservist or territorial) reflected the different nature of the conflicts (Table 6). For the Boer War, most of the servicemen that took part were regulars supplemented with a small group of militia (part-time rural soldiers often used as a source for the regular army) and volunteers (Bond, 1969). World War One, which required mass mobilisation, witnessed the introduction of conscription from January 1916, by which all single men were deemed to have enlisted and transferred to the reserve whence they could be called up as required (Marwick, 1965). A vast citizen army was recruited. Conscription was introduced at the outset of World War Two, though there had been an earlier phase of compulsory training for those aged 20 to 21 and encouragement civilians to join the Territorial Army and other volunteer, part-time units (Prasad & Smythe, 1968). The Korean War saw the call up of reservists and the extension of National Service to supplement a stretched regular army (Jones & Palmer, 2000). British troops sent to the Gulf War were overwhelmingly drawn from the regular army, though small numbers of territorials and reservists were also deployed.

Table 6 Nature of Recruit

War - Disorder	Nature of Recruit					
	Regular	Militia	Territorial	Volunteer	Conscript	Reserve
<i>Victorian campaign</i>						
1. Cardiac	19 (100)	0	0	0	0	0
2. Debility	9 (100)	0	0	0	0	0
<i>Boer War</i>						
1. DAH	178 (89)	11 (5.5)	1 (0.5)	8 (4)	0	2 (1)
2. Rheum.	177 (88.5)	11 (5.5)	0	12 (6)	0	0
<i>World War One</i>						
1. DAH	8 (4)	1 (0.5)	10 (5)	111 (55.5)	67 (33.5)	3 (1.5)
2. Neur.	12 (6)	0	14 (7)	107 (53.5)	54 (27)	13 (6.5)
<i>World War Two</i>						
1. Effort	4 (6)	0	21 (31.3)	5 (7.5)	34 (50.7)	3 (4.5)
2. Psych.	25 (12.5)	0	33 (16.5)	19 (9.5)	111 (55.5)	12 (6)
3. Dysp.	16 (16)	0	35 (35)	3 (3)	33 (33)	13 (13)
<i>Korea/Malaya</i>						
1. Psych	10 (66.7)	0	0	4 (26.7)	1 (6.7)	0
2. Dysp	4 (80)	0	0	1 (20)	0	0
<i>Gulf War</i>						
Gulf-related illness	371 (92.8)	0	15 (3.7)	0	0	14 (3.5)

2. Distribution by Rank

As regards rank, the distribution within samples reflected both the nature of the pension system and the judgements of physicians making the awards (Table 7). Officers were not entitled to war pensions until World War One. Furthermore, a bias favoured officers during and after World War One in terms of entitlement and

percentage awarded because contemporaries believed them more sensitive to the stresses of combat and they had carried responsibility for the men in their units (Mott, 1919). As a result, the neurasthenia sample contains a disproportionate number of officers (17%), while the DAH cohort (2%) has slightly fewer than would be found in the total army population.

The changing relationship between other ranks and NCOs (including acting and non-substantive ranks such as Lance Corporal) is an important feature of the samples. For the two Boer War populations, NCOs represented 20.3% of all other ranks, for the World War One groups they were 29.7% and for the World War Two samples accounted for 41.8%. A study of 627 NCOs admitted to a base psychiatric hospital in the Middle East showed a low incidence of schizophrenia but a high incidence of depression and anxiety states, suggesting that this selected population had been subjected to particular stressors (Sim, 1945). Anecdotal accounts show that some infantry battalions, notably the Green Jackets, encouraged corporals to take initiatives in action (Bowlby, 1969). The increasing incidence of war syndromes amongst NCOs was particularly apparent for the Gulf War population. Over half (58.5%) were NCOs and therefore experienced, regular soldiers who had been selected for promotion. It may be that over the last century responsibility has been progressively devolved to NCOs but that in recent years traditional peer support has been eroded.

Table 7 Ranks

War - Disorder	Rank		
	Other Ranks	NCOs	Officers
<i>Victorian campaigns</i>			
1. Cardiac	15 (79)	4 (21)	0
2. Debility	5 (55.6)	4 (44.4)	0
<i>Boer War</i>			
1. DAH	167 (83.5)	33 (16.5)	0
2. Rheumatism	152 (76)	48 (24.0)	0
<i>World War One</i>			
1. DAH	151 (75.5)	45 (22.5)	4 (2)
2. Neurasthenia	128 (64)	38 (19)	34 (17)
<i>World War Two</i>			
1. Effort syndrome	39 (58.3)	21 (31.3)	7 (10.4)
2. Psychoneurosis	141 (70.5)	47 (23.5)	12 (6)
3. Dyspepsia	59 (59)	32 (32)	12 (12)
<i>Korea/Malaya</i>			
1. Psychoneurosis	12 (80)	2 (13.3)	1 (6.7)
2. Dyspepsia	2 (40)	3 (60)	0
<i>Gulf War</i>			
Gulf-related illness	136 (34)	234 (58.5)	30 (7.5)

Figures in parentheses indicate percentages

3. Type of Unit

The samples have been analysed by type of unit, whether combatant, combat support and non-combatant (Table 8). Combat units, or teeth arms, comprise the infantry, artillery, cavalry/armour, engineers and signals. Combat support included those troops that provided vital services to those in the front line: drivers, cooks, paymasters, intelligence, education, and supplies. Non-combatant units were not

expected to fight though were often exposed to combat and included medical services and unarmed pioneer or labour companies. These distinctions were drawn irrespective of the soldier's actual military experience. They reflect training and determine expectations once war has been declared.

It has been hypothesised that troops in supportive roles, often isolated or denied the protection of a close-knit group, are more prone to stress reactions, though typically exposed to less intense fighting (Glass, 1973). At first sight, this does not appear to be confirmed by the findings as 92.3% of the Boer War samples were from combat units, 84.3% of the World War One groups and 70.3% of the World War Two samples. In August 1914, 92.8% of Britain's 500,000 regular army was composed of combat troops, while combat support units accounted for only 3.5% (*Statistics of the Military Effort*, 1922, 28). By November 1918, when the strength of the British army had risen to 3,759,470, the proportions had changed significantly in response to the increasingly technical nature of war and the need for a long logistics tail to supply mass armies: combat troops accounted for 74.9%, combat support 20.5% and non-combatant were 4.5% (Ibid., 231). The proportion of teeth arms in the Middle East Force, which fought in the Western Desert between 1942 and 1943, had fallen to 63% (James, 1955, 106). For the Boer War and World War One the percentages are not greatly at variance with the overall composition of the armed forces. Historically, combat-support units have grown absolutely and as a proportion as war has become more technical and the medical and other services have improved. The Gulf War sample showed a distinct difference from the earlier pattern as only 53.8% were from combat units and 32.5% from combat support. In practice, however, many regular combat troops in the Gulf were required to undertake support roles because of the greatly reduced size of the British army. The changing composition of the armed forces can explain only part of this phenomenon. Nevertheless, it is important to relate these findings to actual exposure to combat (Table 9).

Table 8 Units

War - Disorder	All Units			Combat Units				
	Combat	Combat support	Non-combat	Infantry	Artillery	Cavalry/ Armour	Engineer	Signals
<i>Victorian campaigns</i>								
1. Cardiac	18 (94.7)	0	1 (5.3)	16 (88.8)	1 (5.6)	1 (5.6)	0	0
2. Debility	7 (77.8)	1 (11.1)	1 (11.1)	3 (42.9)	1 (14.3)	2 (28.6)	1 (14.2)	0
<i>Boer War</i>								
1. DAH	184 (92)	8 (4)	8 (4)	147 (80)	11 (6)	22 (12)	4 (2)	0
2. Rheum	185 (92.5)	5 (2.5)	10 (5)	145 (78.4)	11 (5.9)	25 (13.5)	4 (2.2)	0
<i>World War One</i>								
1. DAH	173 (86.5)	20 (10)	7 (3.5)	128 (74)	26 (15)	2 (1)	17 (10)	0
2. Neur	164 (82)	28 (14)	8 (4)	115 (70.1)	28 (17.1)	5 (3)	16 (9.8)	0
<i>World War Two</i>								
1. Effort	41 (61.2)	22 (32.8)	4 (6)	18 (44)	13 (31.7)	3 (7.3)	7 (17)	0
2. Psych	154 (77)	40 (20)	6 (3)	90 (58.4)	34 (22)	9 (5.9)	12 (7.8)	9 (5.9)
3. Dyspep	72 (72)	24 (24)	4 (4)	36 (36)	18 (25.4)	4 (5.6)	11 (15.5)	3 (4.2)
<i>Korea/ Malaya</i>								
1. Psych	10 (66.7)	4 (26.7)	1 (6.6)	3 (30)	5 (50)	0	1 (10)	1 (10)
2. Dyspep	2 (40)	3 (60)	0	1 (50)	1 (50)	0	0	0
<i>Gulf War</i>								
Gulf related illness	215 (53.8)	130 (32.5)	55 (13.7)	77 (35.8)	50 (23.3)	33 (15.3)	30 (14)	15 (11.6)

The combat units themselves have been analysed (Table 8). The majority of combat troops in the study were from infantry battalions, followed numerically by artillery - a reflection of the British Army's general structure. Although the proportion of men from armoured units increased to around 7% during World War Two, they remained comparatively small when set beside the infantry and artillery. The Gulf War, which saw a major tank offensive, generated a significantly increased proportion from armoured units (15.3%).

4. Combat Exposure

Units and their deployment were researched to discover whether servicemen were exposed to combat irrespective of their training and branch (Table 9). Given the mobile and widespread nature of the fighting, it was not surprising to find that most of the Boer War veterans (77%) had seen action. Only 57% of the DAH pensioners in World War One had been in combat. The percentage for the neurasthenic group was higher (70%) because many had originally been treated for shell shock, a diagnosis not formally recognised by the Ministry of Pensions. However, 26% of this group and 37.5% of the DAH sample had never seen action, many having broken down in training in the UK. The proportions that had seen combat in World War Two were slightly lower: 46.3% of the effort syndrome sample, 41% of the dyspepsia group and 59% of psychoneurosis (a sample which included a number of men that had suffered from battle exhaustion). Nevertheless, the Gulf War sample had the lowest percentage of troops exposed to combat (19.8%). Unit diaries permitted accurate identification of the nature of operations that each individual had been engaged. Most of those with Gulf-related illnesses had served at bases either in Kuwait or Saudi Arabia or had operated in the rear of advancing forces.

Table 9 Combat Exposure

War - Disorder	Combat exposure			Traumatic exposures					
	In combat	No combat	Not known	Gas attack	Explosion	Burial	Wound	Fire attack	Other
<i>Victorian campaign</i>									
1. Card.	18 (94.7)	1 (5.3)	0	0	0	0	2	1	0
2. Deb.	6 (66.7)	1 (11.1)	2 (22.2)	0	0	0	1	0	1
<i>Boer War</i>									
1. DAH	155	5 (2.5)	39 (20)	0	0	0	8	1	7
2. Rheum	(77.5)	7 (3.5)	40 (20)	0	0	0	14	2	8
	153 (76.5)								
<i>World War 1</i>									
1. DAH	114 (57)	75 (37.5)	11 (5.5)	4	12	7	31	2	5
2. Neur.	140 (70)	53 (26.5)	7 (3.5)	6	83	28	39	9	8
<i>World War 2</i>									
1. Effort	31 (46.3)	36 (53.7)	0	3	16	5	9	4	3
2. Psych	118 (59)	72 (36)	10 (5)	0	89	5	43	22	42
3. Dysp	41 (41)	48 (48)	11 (11)	0	10	1	6	2	7
<i>Korea/Malaya</i>									
1. Psych	3 (20)	9 (60)	3 (20)	0	0	0	4	0	3
2. Dysp	0	3 (60)	2 (40)	0	0	0	0	0	2
<i>Gulf War</i>									
Gulf related illness	79 (19.8)	271 (67.8)	50 (12.5)	1	23	0	4	50	223

As regards reported exposure to specific traumas, explosions were the most common, followed by wounds. Other traumas included vehicle and training accidents, together with effects of air raids.

5. Marital Status

Most of the servicemen from all the wars were married either at the time of their service or shortly afterwards (Table 10). Most of the Boer War servicemen were single on enlistment but being regulars had married by the time they were discharged and applied for a pension. The lower proportion for World War One (58%), was a reflection of the youthfulness of the volunteers and conscripts.

Table 10 Marital Status

War - Disorder	Marital Status		
	Single	Married	Not known
<i>Victorian campaigns</i>			
1. Cardiac	2	17	0
2. Debility	0	9	0
<i>Boer War</i>			
1. DAH	29 (14)	166 (83.5)	6 (2.5)
2. Rheum	14 (7)	169 (84.5)	7 (3.5)
<i>World War One</i>			
1. DAH	75 (37.5)	113 (56.5)	12 (6)
2. Neurasth	62 (31)	119 (59.5)	19 (9.5)
<i>World War Two</i>			
1. Effort	4 (5.9)	61 (91)	2 (2.9)
2. Psych.	32 (16)	163 (81.5)	5 (2.5)
3. Dyspep	9 (9)	90 (90)	1 (1)
<i>Korea/ Malaya</i>			
1. Psych	5 (3.3)	10 (6.7)	0
2. Dyspep	3 (60)	2 (40)	0
<i>Gulf War</i>			
Gulf-related illness	92 (23)	302 (75.5)	6 (1.5)

6. Educational Status

Because qualifications and tests varied greatly over the hundred years of the study, it was decided to employ a simple classification (Table 11). The consequences of progressive educational reforms were apparent from the samples. Just over half of the two Boer War samples had no qualifications, while 54% of the World War Two psychoneurosis sample had passed exams at school. Neither the World War One nor the Gulf War records routinely provided information on educational attainment.

Table 11 Educational background

War - Disorder	No qualifications	School qualifications	University/ Professional	Vocational	Not known
<i>Victorian campaigns</i>					
1. Cardiac	9	10	0	0	0
2. Debility	3	6	0	0	0
<i>Boer war</i>					
1. DAH	125 (63)	62 (31)	0	0	13 (7)
2. Rheum.	105 (52.5)	83 (42)	0	0	12 (6)
<i>World War 1</i>					
1. DAH	1 (0.5)	6 (3)	1 (0.5)	0	191 (96)
2. Neurasth	3 (2)	11 (5.5)	3 (1.5)	0	183 (92)
<i>World War 2</i>					
1. Effort	11 (16.4)	19 (28.4)	2 (3)	1 (1.5)	34 (50.7)
2. Psych.	23 (12)	107 (54)	3 (1.5)	3 (1.5)	64 (32)
3. Dyspepsia	19 (19)	18 (18)	0	2 (2)	61 (61)
<i>Korea/Malaya</i>					
1. Psych.	4 (26.7)	7 (46.7)	0	1 (6.7)	3 (20)
2. Dyspepsia	1 (20)	1 (20)	0	0	3 (60)
<i>Gulf War</i>					
Gulf-related illness	19 (4.8)	46 (11.5)	5 (1.3)	5 (1.3)	325 (81)

7. Conduct and Discipline

Most pension files include conduct sheets and an assessment on discharge of a soldier's military character (Table 12). These records show that war syndromes are not associated with poor conduct. Indeed, many of those in the study had exemplary characters and had no charges for misconduct. Taking the two Boer War samples, 73% had committed no or a few minor offences, and for the two World War One groups the proportion was higher (80%). For the three World War Two samples the percentage was lower (55%) though this was in part a reflection of a significantly higher level of missing conduct sheets (38%). Equivalent records were not available for the Gulf War sample as access to personal files was denied, and it only proved possible to assess conduct in a few cases. Servicemen with post-combat syndromes have good disciplinary records.

Table 12 Military Conduct of Servicemen

War - Disorder	Exemplary	1 to 7 offences	8 or more offences	Chronic or serious offender	Not reported
<i>Victorian campaigns</i>					
1. Cardiac	2 (10.5)	13 (68.4)	4 (21.1)	0	0
2. Debility	4 (44.4)	4 (44.4)	0	1 (11.2)	0
<i>Boer War</i>					
1. DAH	53 (26.5)	102 (51)	37 (18.5)	2 (1)	6 (3)
2. Rheum.	47 (23.5)	89 (44.5)	51 (25.5)	7 (3.5)	6 (3)
<i>World War 1</i>					
1. DAH	128 (64)	45 (22.5)	2 (1)	0	25 (12.5)
2. Neurasth	104 (52)	42 (21)	7 (3.5)	6 (3)	41 (20.5)
<i>World War 2</i>					
1. Effort	34 (50.7)	13 (19.4)	2 (3)	1 (1.5)	17 (25.4)
2. Psych.	36 (18)	58 (29)	10 (5)	7 (3.5)	89 (44.5)
3. Dyspepsia	35 (35)	27 (27)	2 (2)	1 (1)	35 (35)
<i>Korea/Malaya</i>					
1. Psych	0	9 (60)	1 (6.7)	1 (6.7)	4 (26.6)
2. Dyspepsia	1 (20)	2 (40)	0	1 (20)	1 (20)
<i>Gulf War</i>					
Gulf-related illness	0	3 (0.7)	8 (2.0)	20 (5.0)	369 (92.3)

8. Alcohol and Smoking

A systematic search was made of all files for alcohol consumption and smoking. The data in war pension records was inconsistent and did not allow for statistical analysis. The Gulf War sample alone had detailed information. Contemporary accounts suggest that the vast majority of soldiers in the Boer War and World War One smoked and drank alcohol. A report in the *Lancet* for 1917 remarked that cigarette smoking 'is almost universal amongst our troops' (1917, 248). In his survey of servicemen with DAH conducted in 1917, Thomas Lewis concluded: 'about 6% are non-smokers or smoke the occasional cigarette. Those who smoke an average of five cigarettes a day are the most numerous, though a considerable number smoke about ten a day, or its equivalent in tobacco... Only 5% confess to excessive smoking (20 cigarettes a day or greater number)' (Lewis, 1917, 54). As regards alcohol consumption, Lewis's DAH patients appeared untypical. An analysis of 454 patients showed that 53% were abstainers, and that only 2% admitted to consuming more than three pints on a daily basis (Lewis, 1917, 58). Giving evidence to the Southborough Committee into shell shock, Lt Col J.S.Y. Rogers, Regimental Medical Officer to the 4th Black Watch during World War One, declared 'had it not been for the rum ration I do not think that we should have won the war' (Southborough, 1922, 68). Alcohol consumption was so widespread during World War One that measures were taken to limit its supply (Dunbar-Miller, 1984). Patterns of smoking and drinking do not appear to have differed greatly during World War Two and in 1940 alcohol abuse was the subject of a special symposium in the French army. The Gulf War sample (Table 13) relied on self report and the results suggested that over half smoked (55%) and most consumed alcohol (85%) in their daily lives.

Table 13 Gulf War sample: smoking and alcohol consumption

	Smoking	Alcohol
Heavy	76 (19)	50 (12.5)
Moderate	144 (36)	290 (72.5)
No consumption	51 (12.8)	11 (2.75)
Not known	129 (32.2)	49 (12.3)
Total	400 (100)	400 (100)

9. Somatisation and Illness

a) Boer War

Since DAH, rheumatism, effort syndrome and non-ulcer dyspepsia are all hypothesised to involve somatisation, it was predicted that in some cases may have been preceded by an organic illness or physical injury. Servicemen faced with the prospect of combat and possible death, may have nurtured a wish to remain sick and unconsciously created somatic symptoms. It was decided to examine recovery rates following organic illness. Each serviceman's medical records were examined for hospital entries preceding the award of a pension for a war syndrome. Many soldiers who fought in the Boer War had been admitted to field hospitals with enteric fever or dysentery. Indeed, physicians at the time believed that a causal link existed between rheumatic fever and valvular disease of the heart (VDH) in adults. Today, cardiologists have established that organic heart disease is unlikely to follow rheumatic fever in individuals over sixteen. All cases of VDH, which showed any sign of organic pathology, were examined by a consultant cardiologist, Dr Stephen Holmberg, before being included in the study. Some cases of VDH were diagnosed largely because the serviceman had suffered from 'simple continued fever' when in South Africa. In acute febrile illness the hyperdynamic circulation can produce a systolic murmur, which in the late nineteenth century, physicians often misinterpreted as a sign of an organic lesion.

b) World War One

The trenches of World War One were insanitary and trench fever was commonplace. The influenza pandemic of 1918 affected large numbers of soldiers. Sir James Mackenzie argued from a survey of over 2,000 soldiers with DAH that in 80% of cases the 'first onset of their illness began with some complaint of an infectious nature, such as measles, influenza, trench fever, typhoid fever, malaria, dysentery or PUO' (Mackenzie, 1920, 534). Having found that 32% of his 558 patients with DAH had suffered from an infectious disease immediately before the onset of cardiac symptoms, Lewis concluded that this was 'the dominant etiological factor' (Lewis, 1918, 33). Furthermore, J.A. Venning analysed 7,803 DAH and VDH cases admitted to No. 1 Convalescent Depot between November 1916 and November 1918 (Venning, 1919, 337-38). He found that infection was the precipitating factor in 21.5% of cases - of which rheumatic fever was the most common complaint (50.3%) followed by PUO (16.3%). Interestingly, Venning believed that the 'physical and mental strain' of active service was the principal cause accounting for 28.2% of cases. 'It was impossible in many cases to distinguish whether the strain was mental or physical, the symptoms produced being identical... The effects of this were clearly shown by the large number of admissions after the German push towards Amiens in March and April 1918' (Ibid., 338).

Between 1880 and the 1930, the observation that neurasthenia frequently followed infection was widely held. For most physicians, including Osler, Oppenheim, Cobb, Horder and others, the principle candidate was influenza, but claims were also made for various alimentary bacteria, typhoid and even the effects of vaccination (Wessely, 1991, 927).

c) World War Two

In June 1941, Dr Paul Wood explored the relationship between infection and the onset of so-called effort syndrome (1941c, 847). Of the 225 cases that he studied, 17 had been preceded by rheumatic fever, influenza, pneumonia and other fevers, while a further 29 had been aggravated by infection. However, Wood discovered that a greater number had been preceded by a traumatic event, including gassing, explosion, concussion or injury. 'The chief factor', he concluded, 'was the belief, induced by the doctor, that the heart had been injured by the infection... It is therefore not surprising that rheumatic fever heads the list of these infections; influenza may come second because of the fallacious belief that it, too, injures the heart and because of its notorious influence on morale' (1941c, 847).

Taking the Boer War samples, 36% of DAH cases and 19% of rheumatism had a physical illness before being diagnosed with these disorders (Table 14). For the World War One samples, 45% of DAH and 40% of neurasthenia had a preceding physical illness. Similar percentages were recorded for effort syndrome (33%) and psychoneurosis (41%) during World War Two. These figures may understate the true incidence as a number of cases that had been preceded by treatable malaria were excluded to be certain that symptoms were not the result of a further episode. The dyspepsia sample had a much higher incidence (83%) because many subjects had been admitted for suspected duodenal ulcer, while others were diagnosed with gastritis or duodenitis in the absence of x-ray evidence for peptic ulcer. Although the GVMAP physicians elicited medical histories for all the Gulf War veterans, detailed records were not made available to us, which may account for low proportion (8%).

Table 14 Physical Illness before war pension

War – Disorder	Physical Illness	No Illness reported	Not known
<i>Victorian campaigns</i>			
1. Cardiac	14 (73.7)	5 (26.3)	0
2. Debility	7 (77.8)	2 (22.2)	0
<i>Boer War</i>			
1. DAH	81 (40.5)	119 (59.5)	0
2. Rheumatism	77 (38.5)	123 (61.5)	0
<i>World War One</i>			
1. DAH	90 (45)	110 (55)	0
2. Neurasthenia	79 (39.5)	119 (59.5)	2 (1)
<i>World War Two</i>			
1. Effort	22 (32.8)	45 (67.2)	0
2. Psychoneurosis	82 (41)	117 (58.5)	1 (0.5)
3. Dyspepsia	83 (83)	15 (15)	2 (2)
<i>Korea/Malaya</i>			
1. Psychoneurosis	4 (26.7)	11 (73.3)	0
2. Dyspepsia	5 (100)	0	0
<i>Gulf War</i>			
Gulf-related illness	32 (8)	242 (61)	0

If those servicemen who sustained a wound are added to those that suffered from a physical illness then the proportions rise further (Table 15). During World War One it was argued that wounded servicemen 'appear to be comparatively immune to shell shock' and 'though some may show a slight degree of nervous exhaustion this is usually a late development, manifesting itself when the wound condition is such that a return to the front becomes a factor to be reckoned with' (Wiltshire, 1916, 1208). Although wounds may initially have served as a protector against shell shock, once recovery was underway some soldiers developed new symptoms or found that progress came to a halt. This evidence suggests that wounds, like physical illness, can serve as a precipitating factor in those particularly susceptible to post-combat syndromes. Indeed, in 1918 Lewis had found that for 63 cases (11%) of DAH the functional cardiac symptoms had been precipitated by wounds, bombardment, gassing or frostbite (Lewis, 1918, 33).

Table 15 Physical Illness and Wounds before Pension

War – Disorder	Illness and or Wound
<i>Victorian Campaign</i>	
1. Cardiac	16 (84.2)
2. Debility	7 (77.8)
<i>Boer War</i>	
1. DAH	85 (42.5)
2. Rheumatism	* 86 (43)
<i>World War One</i>	
1. DAH	103 (51.5)
2. Neurasthenia	102 (51)
<i>World War Two</i>	
1. Effort syndrome	31 (46.3)
2. Psychoneurosis	113 (56.5)
3. Dyspepsia	89 (89)
<i>Korea/Malaya</i>	
1. Psychoneurosis	8 (47.1)
2. Dyspepsia	5 (100)
<i>Gulf War</i>	
Gulf-related illness	NA

10. Demobilisation and Employment

What, then, happened to servicemen with post-combat syndromes once they had been discharged from the army and had been awarded a war pension? Their files were examined to discover how many were able to return to paid employment and how many were so disabled by their symptoms that they were not offered jobs or felt obliged to resign once in post (Table 16). Some 77% of Boer War veterans in the two samples returned to paid employment, while 22% were either unable or unwilling to work. The proportion that were known to have gone back to employment after World War One was noticeably lower (46%). This was in part a function of nature of war pension files, which did not systematically record a veteran's work status. Despite the harsh economic climate of the 1920s and the deep post-war depression, only 4% were known not to be able to work. Under pressure from MPs and veterans' pressure

groups, the Ministry of Pensions introduced re-training schemes for ex-servicemen, who were also given priority by some employers. The vast majority of veterans from the World War Two samples (80%) returned to jobs after 1945. Similarly, most of the Gulf population (63%) were either employed in civilian life or continued to serve in the army. Only 8% were definitely unable to work.

Table 16 Work after discharge

War – Disorder	Working	Not working	Not known
<i>Victorian campaigns</i>			
1. Cardiac	6	0	3
2. Debility	18	0	1
<i>Boer War</i>			
1. DAH	154 (77)	43 (21.5)	3 (1.5)
2. Rheumatism	153 (76.5)	46 (23)	1 (0.5)
<i>World War One</i>			
1. DAH	89 (44.5)	8 (4)	103 (51.5)
2. Neurasthenia	95 (47.5)	7 (3.5)	98 (49)
<i>World War Two</i>			
1. Effort Syndrome	56 (83.6)	3 (4.5)	8 (11.9)
2. Psychoneurosis	154 (77)	11 (5.5)	35 (17.5)
3. Dyspepsia	85 (85)	2 (2)	13 (13)
<i>Korea/Malaya</i>			
1. Psychoneurosis	9 (60)	1 (6.6)	0
2. Dyspepsia	5 (100)	0	0
<i>Gulf War</i>			
Gulf-related illness	253 (63.3)	30 (7.5)	117 (29.3)

11. Attributions for Ill Health

How, then, did servicemen themselves explain these post-combat syndromes? Attributions appear to be culturally conditioned and varied across the century, tied to prevailing health beliefs and concerns (Table 17). Applicants for a war pension were required to state what they thought was the cause of their disability. In the main, there were six categories of explanation:

1. That symptoms were the result of a physical illness acquired while in the army.
2. That symptoms were the result either of a physical injury or the physical strain of campaigning (marching, sleeping on hard ground, completing assault courses).
3. That symptoms were the result of an adverse climate (wet and cold in South Africa) or environment (the heat of the Western desert or monsoon jungle of Burma).
4. That symptoms were the result of a toxic exposure: either to gas in World War One, or chemical and biological weapons or depleted uranium ordnance in the Gulf War.
5. That symptoms were the result of psychological stress caused by combat or the prospect of combat.
6. That symptoms were the result of psychological stress caused by distance from family and friends or particular home worries.

Table 17 Servicemen's attributions

War - Disorder	Physical illness	Injury or physical strain	Climate - environment	Toxic exposure	Psychological stress service	Psychological stress domestic	Not reported
<i>Victorian campaigns</i>							
1. Cardiac	0	4 (21)	2 (10.5)	0	0	0	8 (42.2)
2. Debility	5 (26.3)	2 (22.2)	3 (33.3)	0	0	0	4 (44.5)
<i>Boer War</i>							
1. DAH	51 (25.5)	49 (24.5)	22 (11)	0	2 (1)	0	76 (38)
2. Rheum	35 (17.5)	30 (15)	74 (37)	0	2 (1)	0	58 (29)
<i>World War 1</i>							
1. DAH	35 (17.5)	90 (45)	12 (6)	3 (1.5)	8 (4)	0	52 (26)
2. Neur	11 (5.5)	85 (42.5)	4 (2)	3 (1.5)	68 (34)	1 (0.5)	28 (14)
<i>World War 2</i>							
1. Effort	5 (7.5)	25 (37.3)	5 (7.5)	1 (1.5)	14 (20.9)	6 (9)	11 (16.3)
2. Psych.	9 (4.5)	65 (32.5)	7 (3.5)	1 (0.5)	82 (41)	10 (5)	26 (13)
3. Dyspepsia	12 (12)	44 (44)	10 (10)	0	5 (5)	0	29 (29)
<i>Korea/ Malaya</i>							
1. Psych	2 (13.3)	3 (15)	1 (6.7)	0	2 (13.3)	5 (33.4)	2 (13.3)
2. Dyspepsia	0	3 (60)	0	0	0	1 (20)	1 (20)
<i>Gulf War</i>							
Gulf related illness	1 (0.3)	9 (2.2)	0	137 (34.3)	33 (8.3)	2 (0.5)	218 (54.5)

a) Boer War

The study shows that Boer War servicemen diagnosed with DAH generally believed it to be the result of either physical illness (26%) or of physical exertion (25%). Private Isaac Booker of the Devonshire Regiment, who had been awarded a permanent pension for DAH, wrote: 'my complaint is rather a hard one to fight against, the heart being affected, which is often the cause of me not being able to work for 3 to 4 days together' (PRO, PIN71/1484). Sent to the Mooi River by a forced march, he found himself short of breath and so exhausted that a comrade had to carry his rifle. Booker was subsequently invalided home after a hospital admission. The official medical explanation for DAH was that tight webbing constricted the flow of blood to and from the heart when soldiers were marching, while rheumatic fever was identified as the cause of valvular disease of the heart. Rheumatism was popularly believed to be caused by soaking and sleeping in wet clothes, an explanation adopted by 37% of the sample, while physical illness, enteric fever or dysentery, accounted for a further 18%. Sapper Joseph Woodward of the Royal Engineers, who had fought at the battle of Paardeburg and the relief of Kimberley, caught enteric fever which was followed by rheumatism in his back and legs. He recalled 'the doctor told me that I was out of danger and the sooner I was out of the country the better as the rainy season was coming on' (PRO, PIN71/1003).

b) World War One

A different pattern emerged in World War One with physical exertion accounting for 45% of the DAH sample and 43% of the neurasthenia group. The demands of trench warfare (the appalling conditions in winter, insanitary state and poor food) were considered by many to have caused damage to the heart or central nervous system. For example, Sapper Alfred Avery of the Royal Engineers wrote that DAH followed fourteen months active service in France: 'from March 1918 onwards during the

German offensive in retreating from Ham to Pont Remy sleep was scarce and fatigues very heavy and I found difficulty going to work. Ultimately in October 1918 on complaining to the M.O., I was excused from heavy fatigues' (PRO, PIN26/673).

However, a significant number of neurasthenic pensioners (34%) attributed their symptoms to the psychological stress of military service. They had, perhaps, been educated by psychologically-minded physicians and the gradual incursion of psychological texts into medical and general literature. 2nd Lieutenant Paul Marsland of the Northumberland Fusiliers, who was dazed by a shell burst in March 1918 during the German offensive, collapsed with exhaustion and shakiness. Diagnosed with neurasthenia, he was awarded a 30% pension in August 1918. Showing little sign of recovery, Marsland was referred to a Ministry of Pensions psychotherapy clinic in June 1923 where after eight sessions he had improved sufficiently to return to work and his pension was ended (PIN26/22084).

c) World War Two

World War Two saw this process continue and 41% of the psychoneurosis sample attributed their symptoms to psychological stress arising from military service and a further 5% to stresses related to their domestic situation. By contrast, 44% of the dyspepsia population, who had plausibly somatised emotional conflict, attributed their symptoms to the physical exertions of training and active service. The effort syndrome sample was divided between those who sought a physical explanation (36%) and those that believed psychological stress was the cause (20%). Following Wood's pioneering work at Mill Hill Hospital, cardiologists were encouraged to refer patients with functional symptoms to psychiatrists for treatment that sometimes involved re-education (Jones, 1952).

d) Gulf War

Psychological explanations were significantly absent from the Gulf War sample - only 9% believed that stress played a causal role. Although over half of the population did not volunteer reasons for their symptoms, 34% thought that their condition was the result of toxic exposure. These results seem to show a sharp retreat from the trend of the earlier years of the century towards greater psychological understanding and a willingness to balance competing explanations.

12. Pension Awards

Finally, the pensions themselves were analysed to discover whether significant differences could be detected both in the types of award and the amounts granted. Under the pre-1914 Royal Hospital system virtually all pensions were permanent. After a short conditional period when a veterans' medical state was monitored, an attributed award was granted and the percentage related to reflect the extent to which a man's ability to earn a wage was impaired. Although recipients were on occasion required to attend further medical boards, it was rare for a permanent pension to be reduced even if the man showed signs of improvement. The disorder itself was considered less important than the extent to which a veteran was incapacitated. An ex-serviceman with neurasthenia, for example, who was incapable of leaving his bed, would be granted a 100% pension, while a man who had a contracture of the arm as a result of a gunshot wound, but who could still work, might only receive 25%.

The Royal Hospital system appeared to be relatively generous to ex-servicemen if they could persuade military physicians that they deserved a pension. An aggravated award was converted to an attributed one after several boards if the disability endured. Once a permanent pension had been established, it was not withdrawn except when a veteran committed a civil offence and was imprisoned. The Royal Hospital dealt with relatively small numbers and the majority of applicants were regulars. Both DAH and rheumatism attracted moderate awards (56% and 59% respectively).

From 1917, the Ministry of Pensions operated a different system. Servicemen were examined to ascertain whether the disability was wholly the consequence of military service (attributed) or whether an existing disorder had been made worse by service (aggravated). Attributed pensions could be paid for life. Aggravated awards were usually short lived and terminated when the effect of war was deemed to have passed. The actual amount awarded was determined by a schedule based on actual physical damage. The loss of a two or more limbs entitled a man to 100%, whereas amputation of a leg above the knee was assessed at 60% and below the knee was 50% (*First Annual Report of the Ministry of Pensions*, 1919, 90-91). Shell shock, a disorder without objective clinical signs, was more difficult to categorise. In April 1918, a sub-committee of the Council of consultants, chaired by Frederick Treves, argued that shell shock should be classified either as a severe injury (where recovery was expected) or a very severe injury when the veteran was not expected to get better (PRO, WO32/2791). In practice, the award for shell shock or neurasthenia was between 20% and 40%.

Under pressure to make economies and faced with the discharge of a vast citizen army, the Ministry of Pensions preferred to make aggravated awards and converted attributed ones if the ex-serviceman showed any signs of improvement. Pensions in the DAH sample were granted at a lower rate (33%) than those in the neurasthenia/shell shock group (41%). DAH cases may have been treated less sympathetically because this was accepted as a functional disorder, while neurasthenia, or shell shock, was viewed as a direct consequence of being in action (Table 18).

Table 18 War Pensions

War - Disorder	Attributed	Aggravated	Rejected	Not known	Initial award %
<i>Victorian Campaigns</i>					
1. Cardiac	16 (84.2)	1 (5.3)	0	2 (10.5)	NA
2. Debility	9 (100)	0	0	0	NA
<i>Boer War</i>					
1. DAH	190 (95)	10 (5)	0	0	56.3
2. Rheum	199 (99.5)	1 (0.5)	0	0	58.8
<i>World War One</i>					
1. DAH	136 (68)	63 (31.5)	1 (0.5)	0	33.3
2. Neur	163 (82)	33 (16.5)	4 (2.0)	0	41.1
<i>World War Two</i>					
1. Effort	15 (22.4)	30 (44.8)	22 (32.8)	0	27.8
2. Psych	47 (23.5)	106 (53)	47 (24)	0	22.3
3. Dyspepsia	41 (41)	41 (41)	18 (18)	0	22.5
<i>Korea/Malaya</i>					
1. Psych	1 (6.7)	0	14 (93.3)	0	14.3
2. Dyspepsia	5 (100)	0	0	0	22.0
<i>Gulf War</i>					
Gulf-related illness	NA	NA	NA	NA	NA

NA - not available

World War Two saw the number of attributed awards fall dramatically as doctors were instructed to take the serviceman's pre-war constitution and medical history into account. In this way, it was very difficult to make a case for an attributed pension for any psychological disorder. Equally, it enabled doctors to reject many claims where the soldier had symptoms and could demonstrate a disability if it could be established that these effects were present before military service. Percentage awards also showed a reduction - only 22% for psychoneurosis and 28% for effort syndrome. Greater effort was made to treat servicemen before they left the forces or to find them duties that they could perform in an attempt to avoid the pension epidemic that followed World War One. This strategy was largely successful and is reflected in these results.

Although war pensions have been granted to Gulf War veterans, we have not been granted access to these files.

STATISTICAL ANALYSIS

The data has been analysed by Professor Brian Everitt in three ways:

1. *Severity* (mean number of symptoms); this basic indicator of severity was calculated for each veteran and then a number of analysis of variance models were used to look at differences between the categories of variables such as war, diagnosis, rank, and exposure to combat. Significant effects were further investigated using Tukey's multiple comparison procedure. Means and standard deviations were also tabulated.
2. *Mahalanobis distances* for diagnoses, wars and type of serviceman (both recruit and rank) were calculated on the basis of the 94-symptom profile available for each veteran. These distances were then displayed in two-dimensions using classical multidimensional scaling.
3. *Cluster analysis* of symptoms for different wars and diagnosis were undertaken to assess how these symptoms grouped together in different situations. (This was preferred to the more usual factor analysis approach that might have been used for the same purpose because of the small number of veterans in some categories and because the a factor analysis of 94 symptoms is not an appealing prospect.)

The results of these different exploratory analyses are now reported in detail.

1. Analysis of Severity

The number of symptoms suffered by each veteran was analysed as a basic indication of severity. An earlier study of Gulf-related illness had shown that Gulf veterans compared with servicemen deployed to Bosnia and a group at other postings experienced the same pattern of symptoms though at a significantly more severe levels (Unwin et al, 1999).

Analyses of variance of severity were undertaken for the following factors:

1. Wars
2. Diagnosis
3. Rank
4. Type of recruit
5. Type of Unit
6. Traumatic exposure

The only evidence of an interaction between any of these factors was that for war by rank. Interpretation of this interaction can be made with the aid of a table of mean severity by war and rank (Table 19).

Table 19 Symptom means

War - Rank	Officers	NCOs	Other Ranks
Victorian campaigns	NA	0.09 (0.03)	0.09 (0.03)
Boer War	NA	0.10 (0.03)	0.10 (0.03)
World War One	0.19 (0.07)	0.12 (0.05)	0.13 (0.06)
World War Two	0.17 (0.07)	0.18 (0.06)	0.17 (0.06)
Korean/Malaya	0.22 (NA)	0.17 (0.06)	0.16 (0.06)
Gulf War	0.14 (0.05)	0.16 (0.07)	0.17 (0.09)

Figures in brackets are standard deviations

Table 19 shows that for other ranks (62.6% of the total population) the number of symptoms tended to increase over time, though veterans of World War Two had marginally higher scores. In part, this was probably a feature of the nature of sources. World War Two pension records are in general more comprehensive than their World War One counterparts, many containing detailed reports from discharge until death. These means suggest that the claim for symptoms to have increased since 1945 and for recent servicemen to be more tender in their ills are not substantiated. The severity of symptoms for World War Two was marginally greater than that for the Gulf War. Officers recorded the highest severity scores for World War One and the lowest for the Gulf War.

The severity of symptom means for the other factors are also included (Tables 20 and 21).

Table 20 Means and Standard Deviations by Types of Recruit

<i>Types of Recruit</i>	Numbers	Means (Standard Deviation)
Regular	804	0.13 (0.07)
Militia	24	0.11 (0.03)
Territorial	129	0.17 (0.07)
Volunteer	264	0.14 (0.06)
Reserve	91	0.15 (0.07)
Conscript	304	0.15 (0.06)
<i>Rank</i>		
Officer	101	0.17 (0.07)
NCO	504	0.14 (0.07)
Other Ranks	1011	0.14 (0.07)
<i>Type of Unit</i>		
Combat	1226	0.14 (0.07)
Combat Support	285	0.16 (0.07)
Non-combat	105	0.14 (0.05)

Table 21 Means and Standard Deviations by Diagnosis

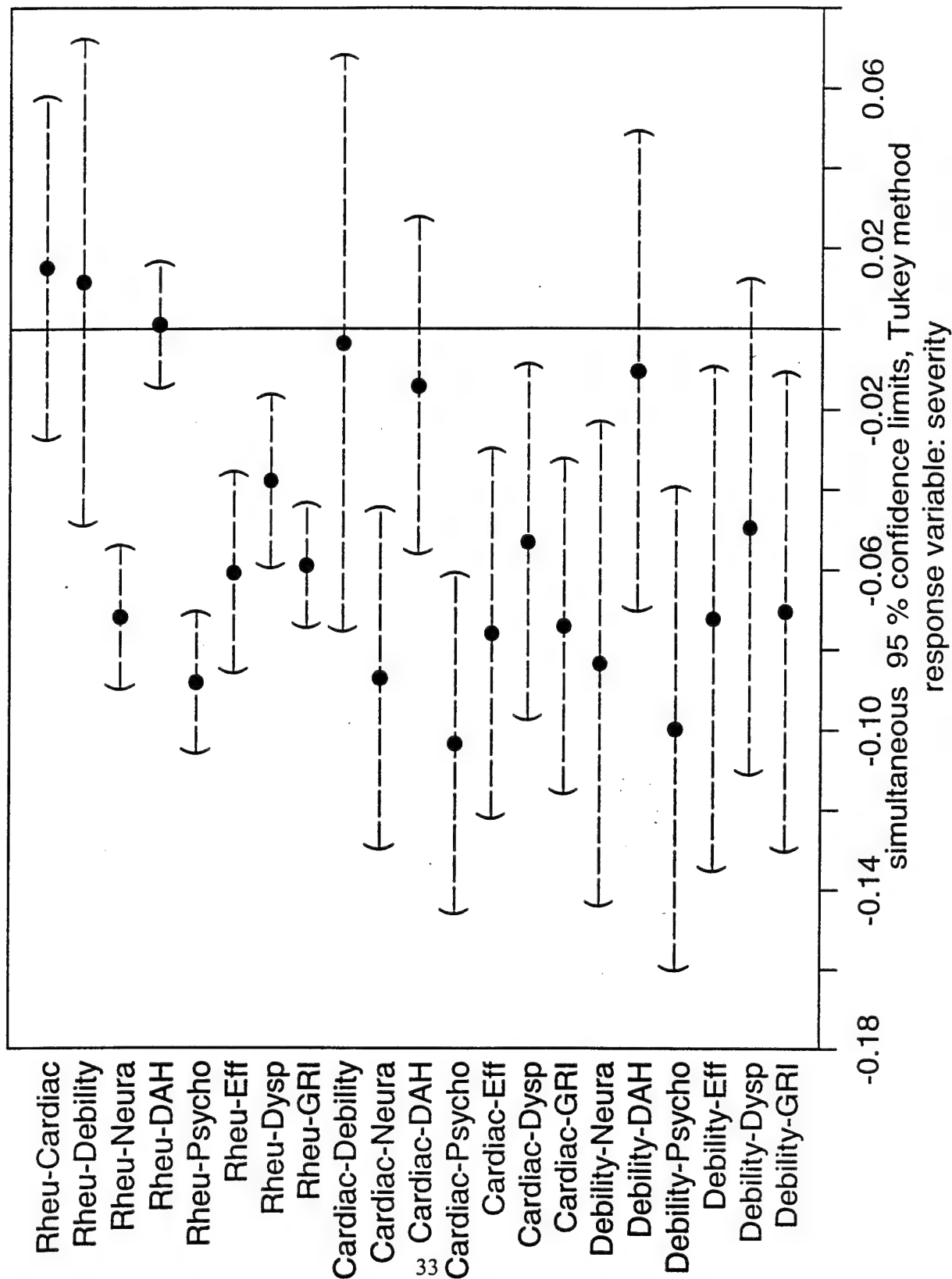
Diagnosis	Number	Mean (Standard Deviation)
Cardiac	19	0.09 (0.04)
Debility	9	0.09 (0.03)
Rheumatism	200	0.10 (0.10)
DAH (Boer and WW1)	400	0.10 (0.04)
Neurasthenia	200	0.17 (0.06)
Psychoneurosis	215	0.19 (0.06)
Effort syndrome	68	0.07 (0.07)
Dyspepsia	105	0.05 (0.05)
Gulf-related illness	400	0.17 (0.07)

Although the analyses of variance showed that the severity means of the categories of each of these factors differed, a more detailed analysis is required to identify just which particular categories differed. Here Tukey's multiple comparison procedure was used with simultaneous confidence intervals being calculated for the difference in mean severity for each pair of categories within a factor. These confidence intervals are presented below.

1. *Diagnosis*

Table 22 shows the results of Tukey's procedure. The severest diagnosis is placed second and those differences that are statistically significant are marked with an asterisk. Gulf-related illness had significantly more symptoms than all the other war syndromes apart from effort syndrome, psychoneurosis and neurasthenia/shell shock (Figure 1). Effort syndrome had significantly more symptoms than DAH (Boer War and World War One combined), psychoneurosis, rheumatism and cardiac disorder and debility from the Victorian campaigns. Psychoneurosis was of significantly greater severity than DAH and rheumatism, reflecting the trend for the number of symptoms to increase over time.

Figure 1 Differences in Severity by Diagnosis



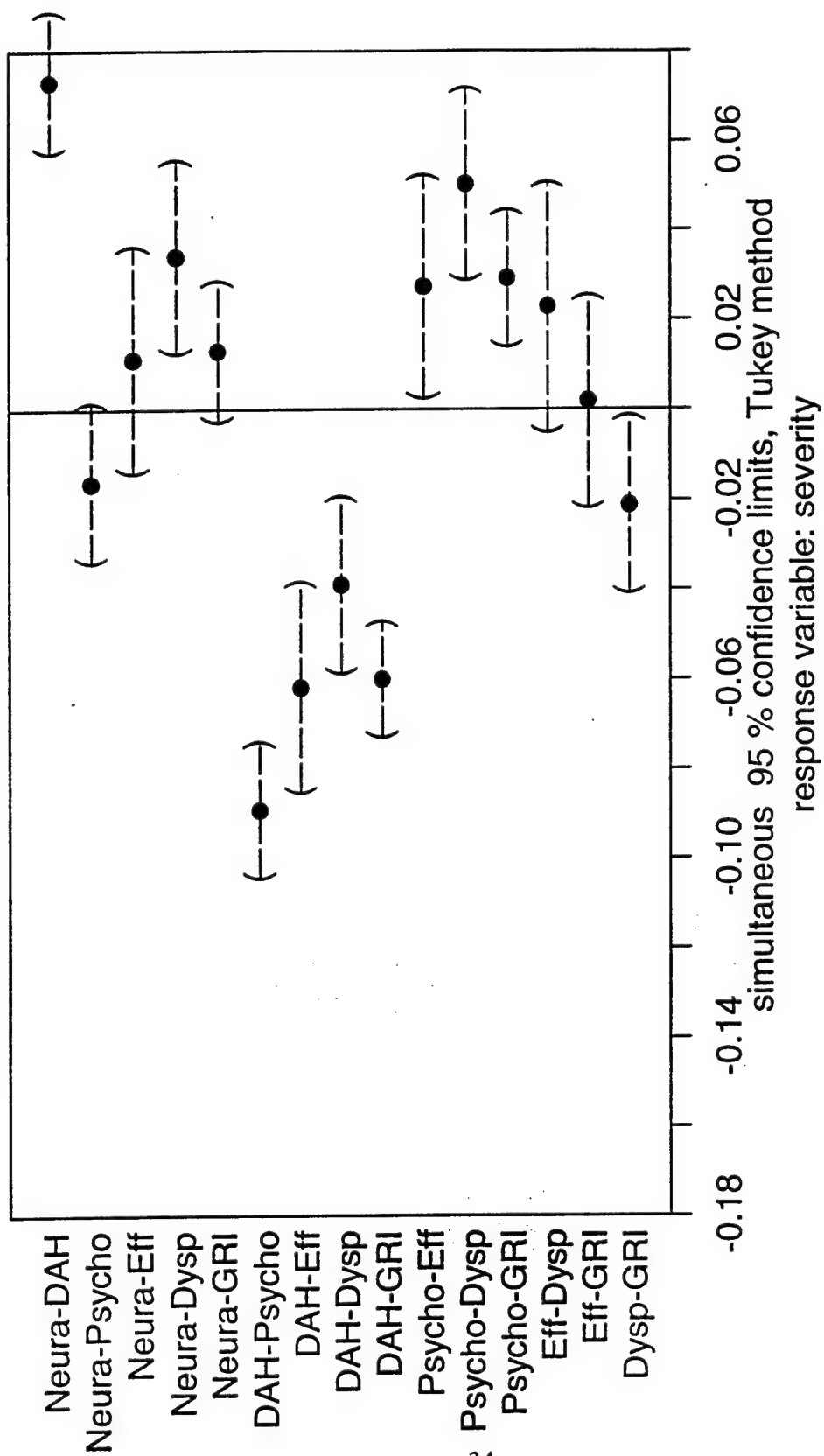


Table 22 Multiple comparison Confidence Intervals for Diagnosis

Diagnosis	Mean difference	Standard Error of difference	95% CI for difference
Rheu v. Cardiac	0.02	0.01	-0.03 to 0.06
Rheu v. Debility	0.01	0.02	-0.05 to 0.07
Rheu v. Neur	-0.07	0.01	-0.09 to -0.05**
Rheu v. DAH	0.01	0.01	-0.01 to 0.02
Rheu v. Psych	-0.09	0.01	-0.12 to -0.07**
Rheu v. Effort	-0.06	0.01	-0.09 to -0.04**
Rheu v. Dyspepsia	-0.04	0.01	-0.06 to -0.02**
Rheu v. Gulf illness	-0.06	0.01	-0.07 to -0.04**
Card. v. Debility	-0.01	0.02	-0.08 to 0.07
Card v. Neur	-0.09	0.01	-0.13 to -0.04**
Card v. DAH	-0.01	0.01	-0.06 to 0.03
Card v. Psych	-0.10	0.01	-0.12 to -0.06**
Card v. Effort	-0.07	0.01	-0.12 to -0.03**
Card v. Dyspepsia	-0.05	0.01	-0.09 to -0.01**
Card v. Gulf illness	-0.07	0.01	-0.12 to -0.03**
Debility v. Neur	-0.08	0.02	-0.14 to -0.02**
Debility v. DAH	-0.01	0.02	-0.07 to 0.05
Debility v. Psych	-0.10	0.02	-0.16 to -0.03**
Debility v. Effort	-0.07	0.02	-0.14 to -0.01**
Debility v. Dyspepsia	-0.05	0.02	-0.11 to 0.01
Debility v. Gulf illness	-0.07	0.02	-0.13 to -0.01**
Neur v. DAH	0.07	0.01	0.06 to 0.09 **
Neur v. Psych	-0.02	0.01	-0.03 to 0.01
Neur. v. Effort	0.01	0.01	-0.01 to 0.04
Neur v. Dyspepsia	0.03	0.01	0.01 to 0.06**
Neur v. Gulf illness	0.01	0.01	-0.01 to 0.03
DAH v. Psych	-0.09	0.01	-0.10 to -0.07**
DAH v. Effort	-0.06	0.01	-0.09 to -0.04 **
DAH v. Dyspepsia	-0.04	0.01	-0.06 to -0.02**
DAH v. Gulf illness	-0.06	0.01	-0.07 to -0.05**
Psych v. Effort	0.03	0.01	0.01 to 0.05**
Psych v. Dyspepsia	0.05	0.01	0.03 to 0.07**
Psych v. Gulf illness	0.03	0.01	0.01 to 0.04**
Effort v. Dyspepsia	0.02	0.01	-0.01 to 0.05
Effort v. Gulf illness	0.01	0.01	-0.02 to 0.02
Dysp v. Gulf illness	-0.02	0.010.01	-0.04 to -0.01**

Key: ** Significant differences (intervals excluding 0).

2. Wars

A comparison of wars by severity (by gathering together all the diagnoses from the same conflict) revealed a progressive increase in the number of symptoms over time (Table 23). Both World War One and Two had greater severity than the Boer War, while World War Two was more severe than World War One (Figure 2). The Gulf War generated a greater number of symptoms than the Boer War and World War One though not significantly more than for World War Two.

Figure 2 Differences in Severity by Wars

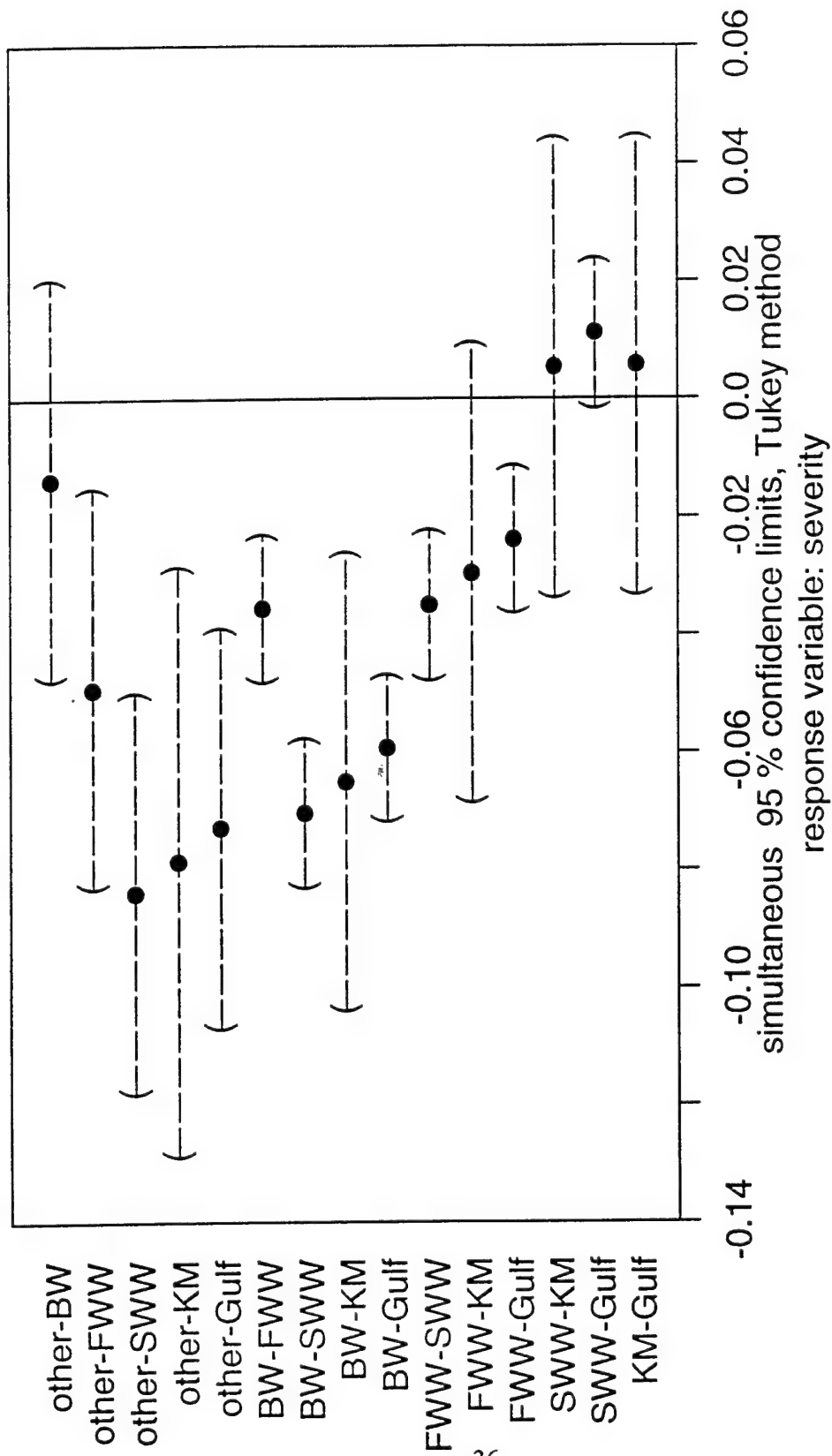


Table 23 Multiple comparison Confidence Intervals for War

War	Mean difference	Standard Error of difference	95% CI for difference
Victorian v. Boer	-0.02	0.01	-0.05 to 0.02
Victorian v. WW1	-0.05	0.01	-0.08 to -0.02**
Victorian v. WW2	-0.08	0.01	-0.12 to -0.05**
Victorian v. Korea	-0.08	0.02	-0.13 to -0.05**
Victorian v. Gulf	-0.07	0.01	-0.11 to -0.04**
Boer v. WW1	-0.04	0.05	-0.05 to -0.02**
Boer v. WW2	-0.07	0.01	-0.08 to -0.06**
Boer v. Korea	-0.07	0.01	-0.10 to -0.03**
Boer v. Gulf	-0.06	0.01	-0.07 to -0.05**
WW1 v. WW2	-0.03	0.01	-0.05 to -0.02**
WW1 v. Korea	-0.03	0.01	-0.07 to 0.01
WW1 v. Gulf	-0.02	0.01	-0.04 to -0.01**
WW2 v. Korea	0.01	0.01	-0.03 to 0.04
WW2 v. Gulf	0.01	0.01	-0.01 to 0.02
Korea v. Gulf	0.01	0.01	-0.03 to 0.04

Key: ** indicate intervals excluding 0

3. Rank

Rank has traditionally been associated with health outcomes. One study of mortality among veterans showed that NCOs had a 23% advantage over other ranks and officers a 40% advantage (Seltzer & Jablon, 1977). With the exception of the Gulf War, this study suggests that rank did not appear to have offered protection against severity of symptoms (Table 24). For example, there was no significant difference between other ranks and NCOs for the Victorian campaigns and the Boer War. Officers had significantly more symptoms than NCOs and other ranks in World War One and Korea (Table 19). However, the Korean sample was very small and the World War One effect is probably explained by the nature of the sources. Officers had more detailed pension files and as they were examined by fellow officers in a class-conscious age seem to have been examined more sympathetically than NCOs. This may explain why more symptoms were documented. As egalitarian ideas spread during the twentieth century, so the tendency for officers to receive preferential treatment declined. For World War Two, when the pension records were standardised, there was no discernible difference between the three groups.

An earlier study of Gulf War veterans had shown that rank was associated with all health outcomes; privates were around 20% more likely to report ill health than NCOs and around 70% more likely than officers (Ismail, 2000, 837). These findings are replicated by our study which showed that officers, who had served in the Gulf War, had the lowest severity, while other ranks had the greatest number of symptoms.

Table 24 Rank compared with Severity by War (ANOVA)

Variable	DF	Sum of Sq.	Mean Sq.	F value	Pr (F)
War	5	1.23	0.25	68.18	<0.001
Rank	2	0.03	0.02	4.26	0.014
War-Rank	8	0.12	0.02	4.27	<0.001

4. Type of Recruit

As regards type of recruit, both territorials and conscripts recorded significantly greater severity than regulars (Table 25). Volunteers and conscripts both had more symptoms than territorials were slightly lower (Figure 3). Territorials, reservists and conscripts had greater severity than militia, though this may have been a function of the small sample size of the last. No significant difference was found between reservists and regulars.

Table 25 Multiple comparison Confidence Intervals for Type of Recruit

Type of recruit	Mean difference	Standard Error of difference	95% CI for difference
Regular v. Milita	0.03	0.01	-0.01 to 0.06
Regular v. Territorial	-0.04	0.01	-0.06 to -0.02**
Regular v. Volunteer	-0.01	0.01	-0.02 to 0.01
Regular v. Conscript	-0.02	0.01	-0.03 to -0.01**
Regular v. Reserve	-0.02	0.01	-0.04 to 0.01
Militia v. Territorial	-0.07	0.01	-0.12 to -0.02**
Militia v. Volunteer	-0.03	0.01	-0.07 to 0.01
Militia v. Conscript	-0.04	0.01	-0.08 to -0.01**
Militia v. Reserve	-0.04	0.02	-0.09 to -0.01**
Territorial v. Volunteer	0.03	0.01	0.01 to 0.06**
Territorial v. Conscript	0.02	0.01	0.01 to 0.04**
Territorial v. Reserve	0.02	0.01	-0.01 to 0.05
Volunteer v. Conscript	-0.01	0.01	-0.03 to 0.01
Volunteer v. Reserve	-0.01	0.01	-0.04 to 0.01
Conscript v. Reserve	-0.01	0.01	-0.02 to 0.02

Key: ** indicate intervals excluding 0.

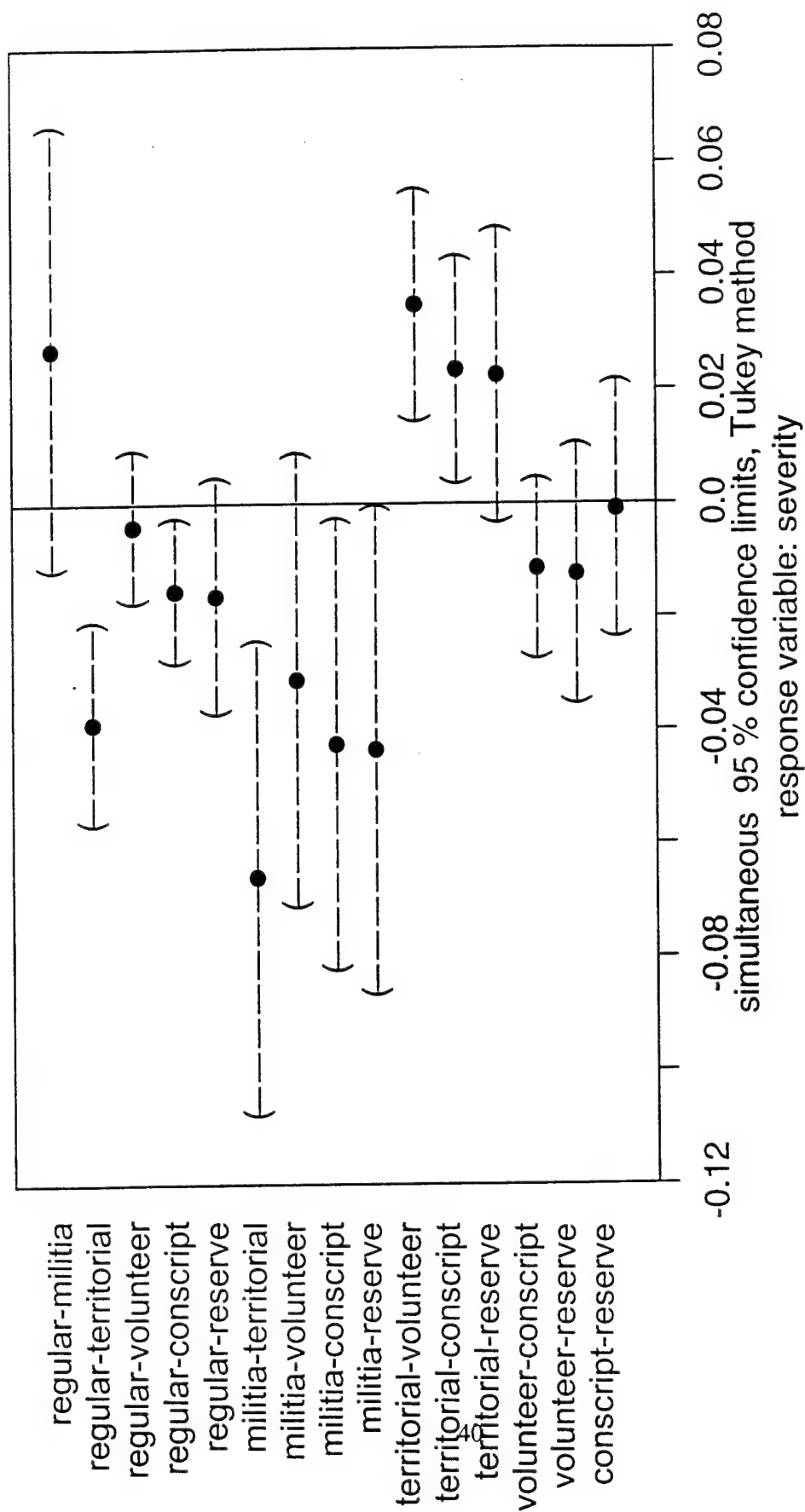
5. *Type of Unit*

As regards types of unit, combat-support troops had a slightly higher severity mean than non-combat and combat units (Table 20), though no significant difference was found between the three groups (Table 26).

Table 26 Severity by Type of Unit (ANOVA)

Type of unit	Mean	Standard Error	95% CI
Non-combat v. combat	-0.01	0.01	-0.02 to 0.02
Non-combat v. combat support	-0.02	0.01	-0.04 to -0.01
Combat v. combat support	-0.02	0.01	-0.03 to 0.01

Figure 3 Differences in Severity by Type of Recruit



2. Mahalanobis distances

Mahalanobis distances were calculated for the categories of war, diagnosis and type of serviceman. The distance measure is based on the differences between the category mean profiles, taking into account the covariance structure of the symptoms.

a) Diagnosis

Table 27 gives the distance matrix for the nine diagnoses.

Table 27 Mahalanobis distances for diagnosis

	Rheum	Card	Deb	Neur	DAH	Psych	Effort	Dysp	Gulf
Rheum	0.00	17.2	10.6	26.17	19.59	34.15	27.45	39.2	32.67
Card	17.20	0.00	19.22	17.78	3.55	29.06	14.46	38.57	26.81
Deb	10.6	19.21	0.00	21.35	21.36	28.64	26.88	38.40	26.07
Neur	26.17	17.78	21.35	0.00	14.15	7.74	9.84	29.50	18.49
DAH	19.59	3.55	21.36	14.15	0.00	23.94	7.04	35.73	24.67
Psych	34.15	29.06	28.64	7.74	23.94	0.00	13.27	25.38	16.65
Effort	27.45	14.46	26.88	9.84	7.04	13.24	0.00	29.99	21.09
Dysp	39.67	38.57	38.57	29.50	35.73	25.38	29.99	0.00	32.41
Gulf	32.67	26.81	26.81	18.49	24.67	16.65	21.09	32.41	0.00

The easiest way to assess these distances is to represent them in two-dimensions by some form of multi-dimensional scaling (MDS). Here classical MDS was used. The results have been expressed as plots (Figures 4, 5 and 6). In terms of mean profile, Gulf-related illness shows the greatest similarity to neurasthenia/shell shock and effort syndrome and to a lesser extent to psychoneurosis. Average linkage clustering on Mahalanobis distances suggests that there are three sub-groups of war syndromes: rheumatism/debility; irritable heart (cardiac), DAH and effort syndrome; neurasthenia/psychoneurosis, and that Gulf-related illness is most closely linked to the third sub-group (Figure 7). Rheumatism and debility were both popular Victorian diagnoses with common symptoms and causal explanations. Irritable heart or palpitation (referred to as Cardiac in the tables), DAH and effort syndrome all referred to functional cardiac disorders at different periods of time. Psychoneurosis was the term employed in World War Two for many of the presentations that in World War One would have been called shell shock or neurasthenia. Dyspepsia stands alone. This is probably explained by the self-contained nature of the cases. Many had initially been diagnosed as suspected duodenal ulcer and exhibited signs of duodenitis or gastritis. Their investigation and treatment were confined to radiologists and gastro-enterologists, who confined their clinical investigations to the stomach and bowel. It is possible, therefore, that a range of psychological, cognitive and behavioural symptoms were not recorded. A complete linkage based on Mahalanobis distances suggests that there are two groups of war syndromes: the first comprising two sub-groups (cardiac and DAH; rheumatism and debility); and the second comprising neurasthenia and psychoneurosis to which effort syndromes, Gulf-related illness and dyspepsia are then linked (Figure 8).

Figure 4 Plot of Diagnoses based on Mahalanobis distances

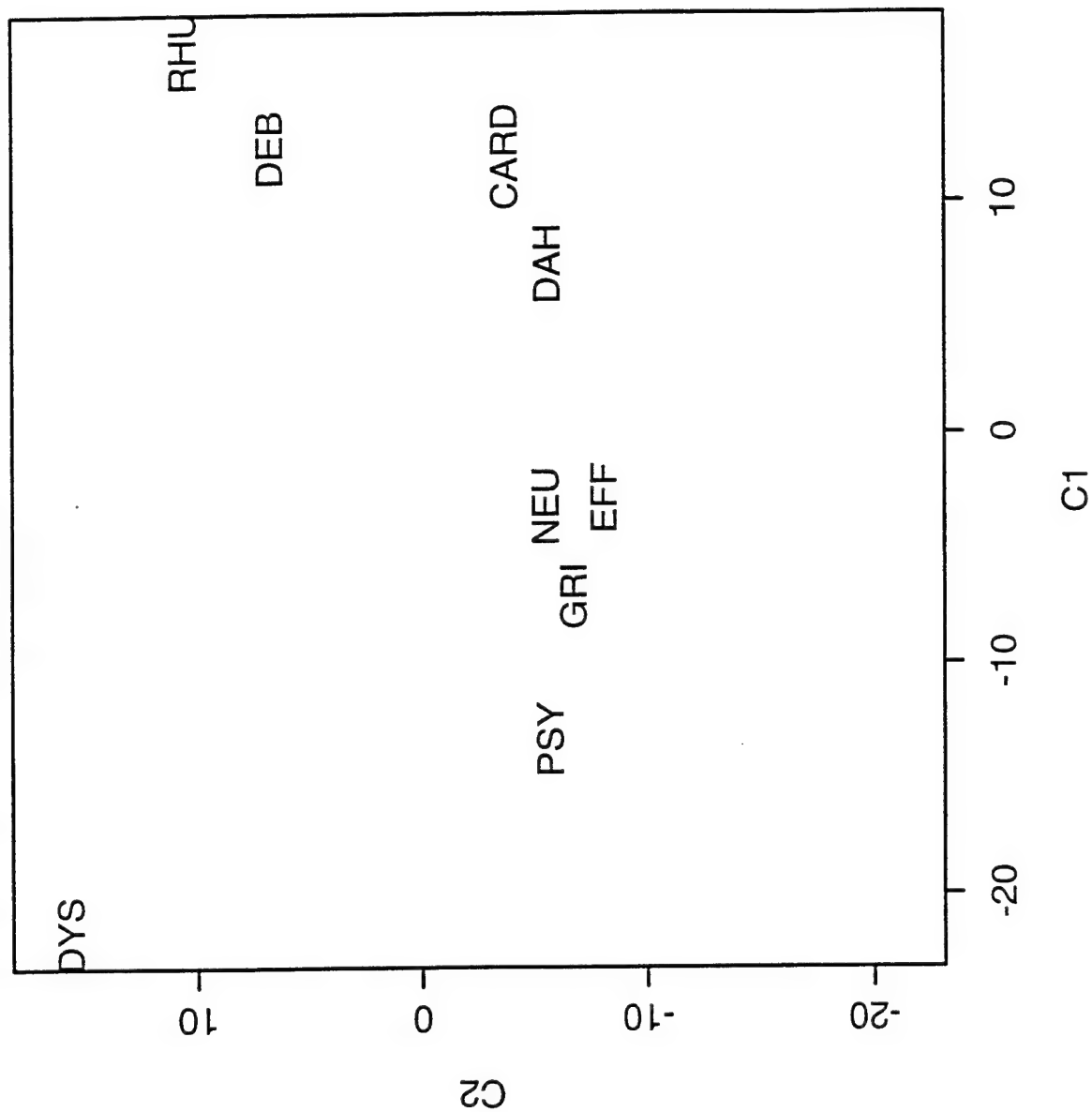


Figure 5 Plot of Diagnoses based on Mahalanobis distances

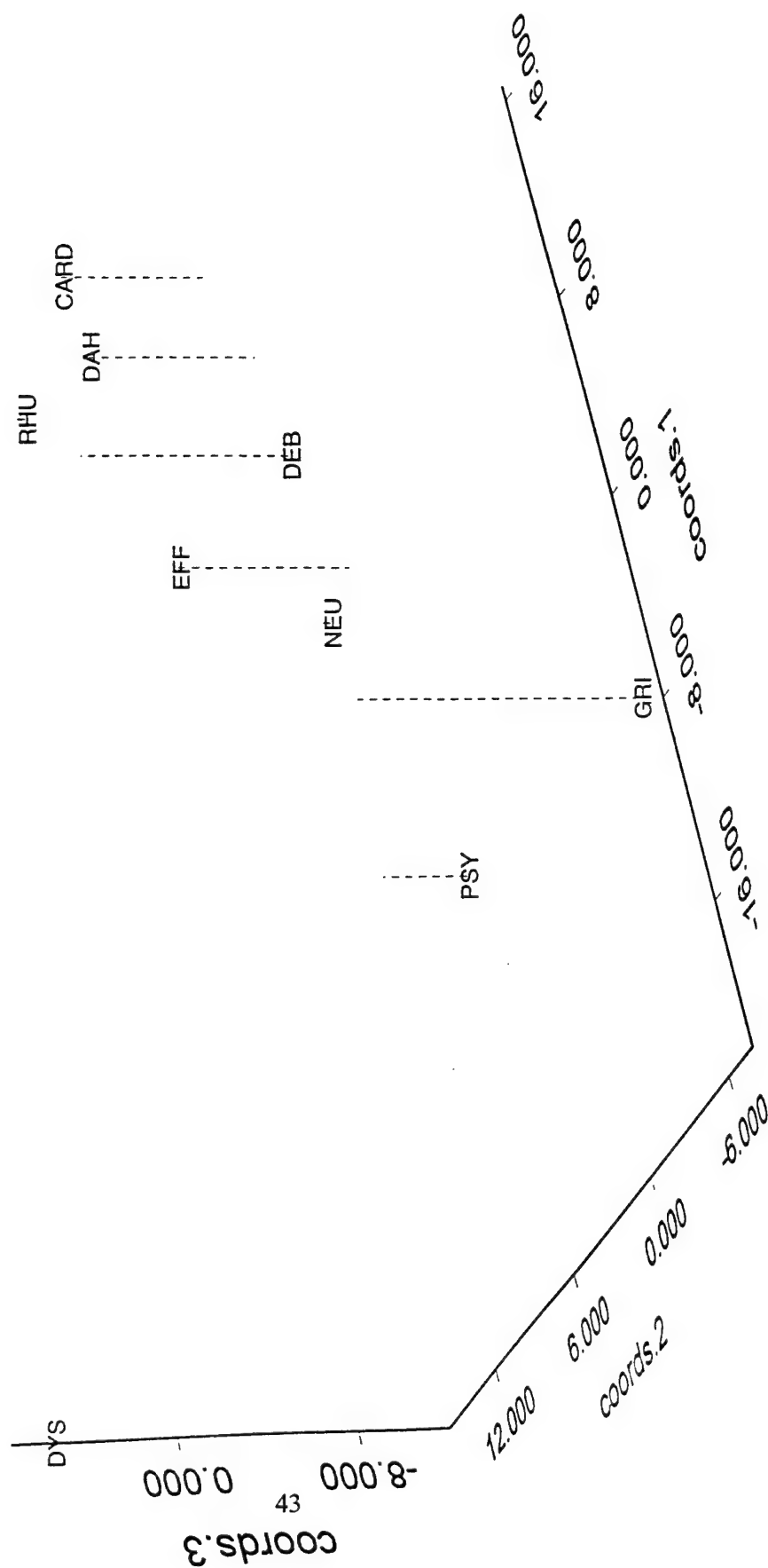


Figure 6 Plot of Diagnoses based on Mahalanobis distances

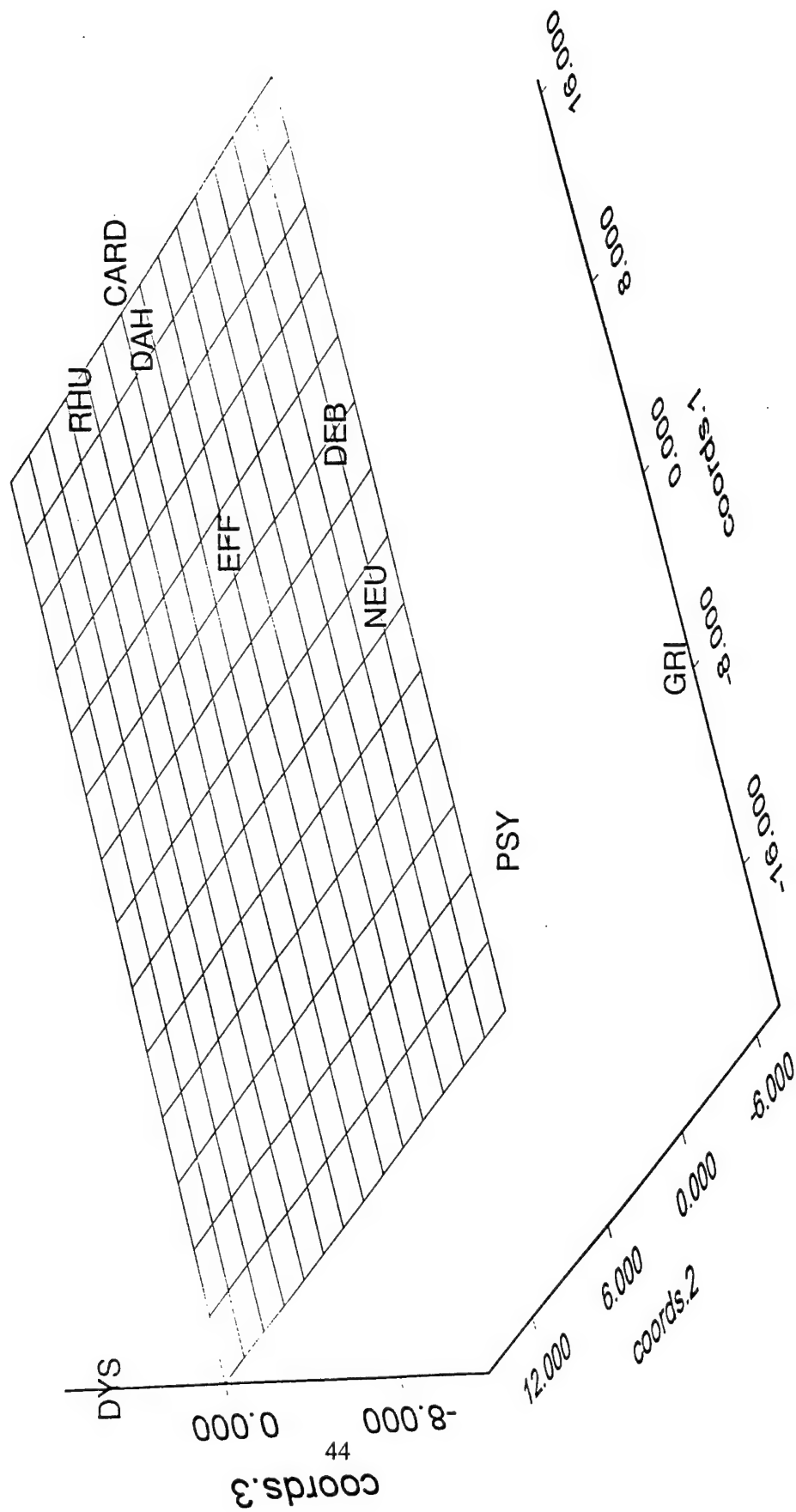


Figure 7 Average linkage on Mahalanobis distances for diagnoses

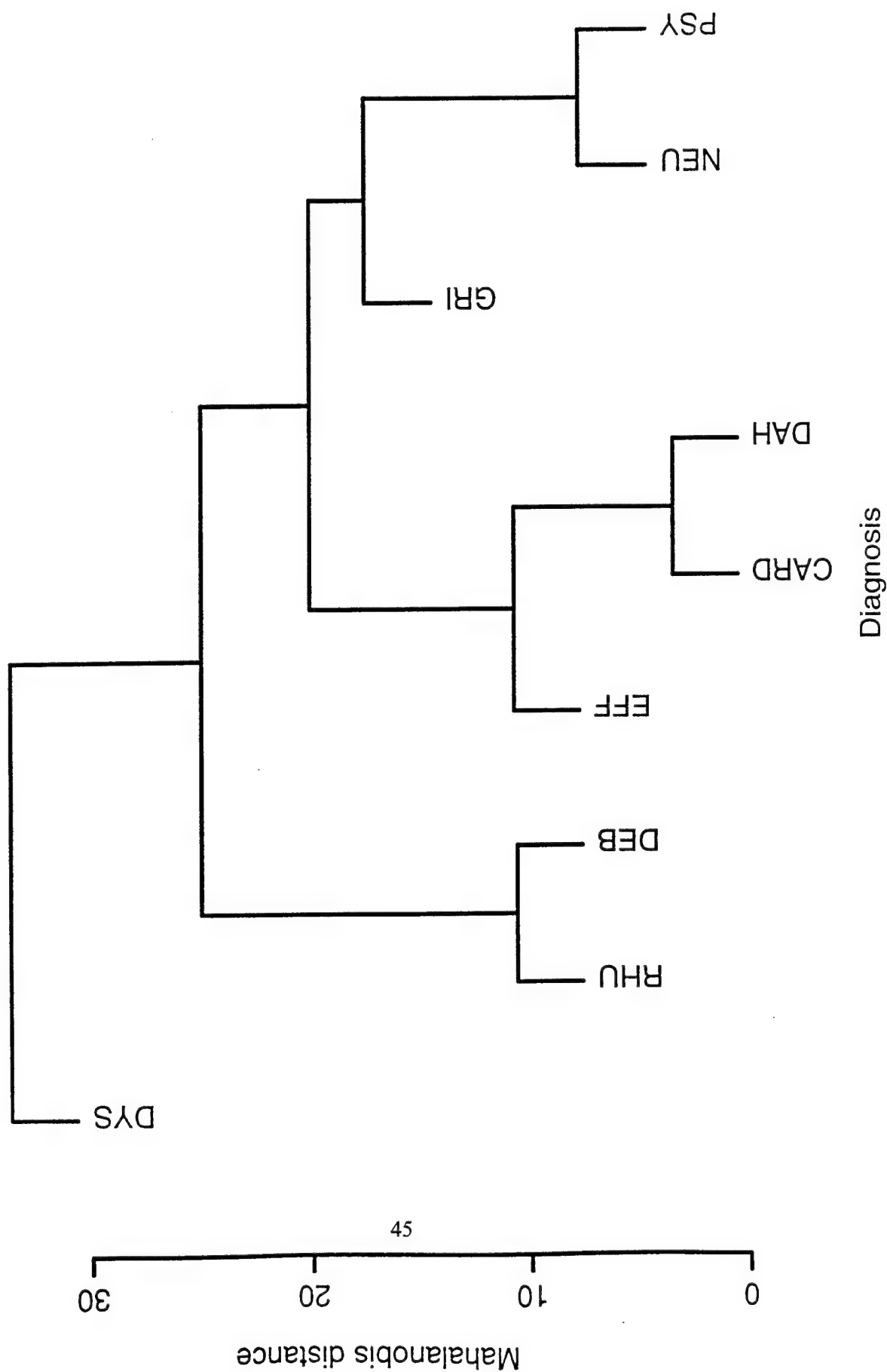
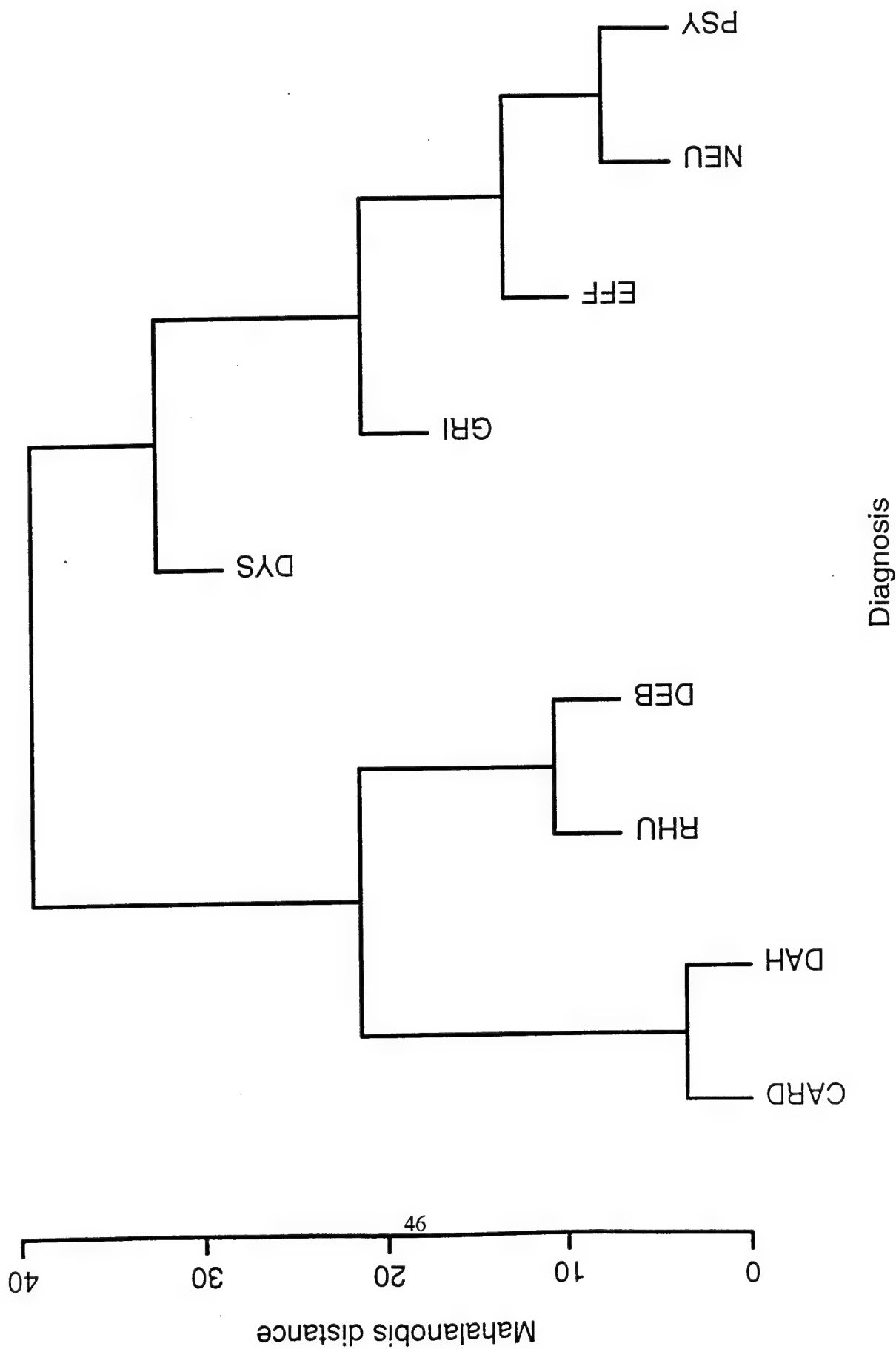


Figure 8 Complete linkage on Mahalanobis distances for diagnoses



b) Wars

A distance matrix has been calculated for the various conflicts (Table 28). As regards differences between wars, the Gulf conflict appears to stand apart from the others (Figure 9). Similarities existed between the Victorian campaigns and the Boer War, and also between World War One and World War Two. This implies an important temporal variable. This suggests that the form adopted by war syndromes evolved gradually over time, possibly in response to changes in medical knowledge, health beliefs and possible new hazards.

Table 28 Mahalanobis distances by war

War	Victorian	Boer	WW1	WW2	Korea/ Malaya	Gulf
Victorian	0.00	2.67	6.72	15.85	30.01	20.94
Boer	2.67	0.00	6.49	14.79	29.03	22.62
WW1	6.72	6.49	0.00	6.42	20.05	16.82
WW2	15.85	14.79	6.42	0.00	10.14	15.13
Korea/ Malaya	30.01	29.03	20.05	10.14	0.00	19.37
Gulf	20.94	22.62	16.82	15.13	19.37	0.00

c) Type of recruit

A Euclidean distance matrix has been calculated by type of recruit (Table 29).

Table 29 Mahalanobis distances for types of serviceman

Recruit	Regular	Militia	Territorial	Volunteer	Conscript	Reserve
Regular	0.00	3.18	4.09	2.99	3.5	1.78
Militia	3.18	0.00	7.97	5.39	6.70	4.43
Territorial	4.09	8.0	0.00	2.72	2.17	3.64
Volunteer	3.0	5.39	2.72	0.00	1.55	3.39
Conscript	3.50	6.70	2.17	1.56	0.00	3.59
Reserve	1.78	4.43	3.64	3.39	3.59	0.00

As regards type of serviceman, regulars and reservists formed one group, while volunteers, conscripts and territorials fell into a second (Figure 10). This is an explicable distinction as reservists are regulars that have served their time and returned to civilian life on the understanding that they can be recalled in time of national emergency. Both groups are professional soldiers who have volunteered for service.

Conscripts and volunteers formed a second group, to which territorials were related. These three types of recruit are civilians who in time of war have either chosen to serve in the armed forces or who have been compelled to join up; they are not professional soldiers. The militia form a separate group, though given their very small numbers their position in the plot may not be accurately estimated.

Figure 9 Plot of Wars based on Mahalanobis distances

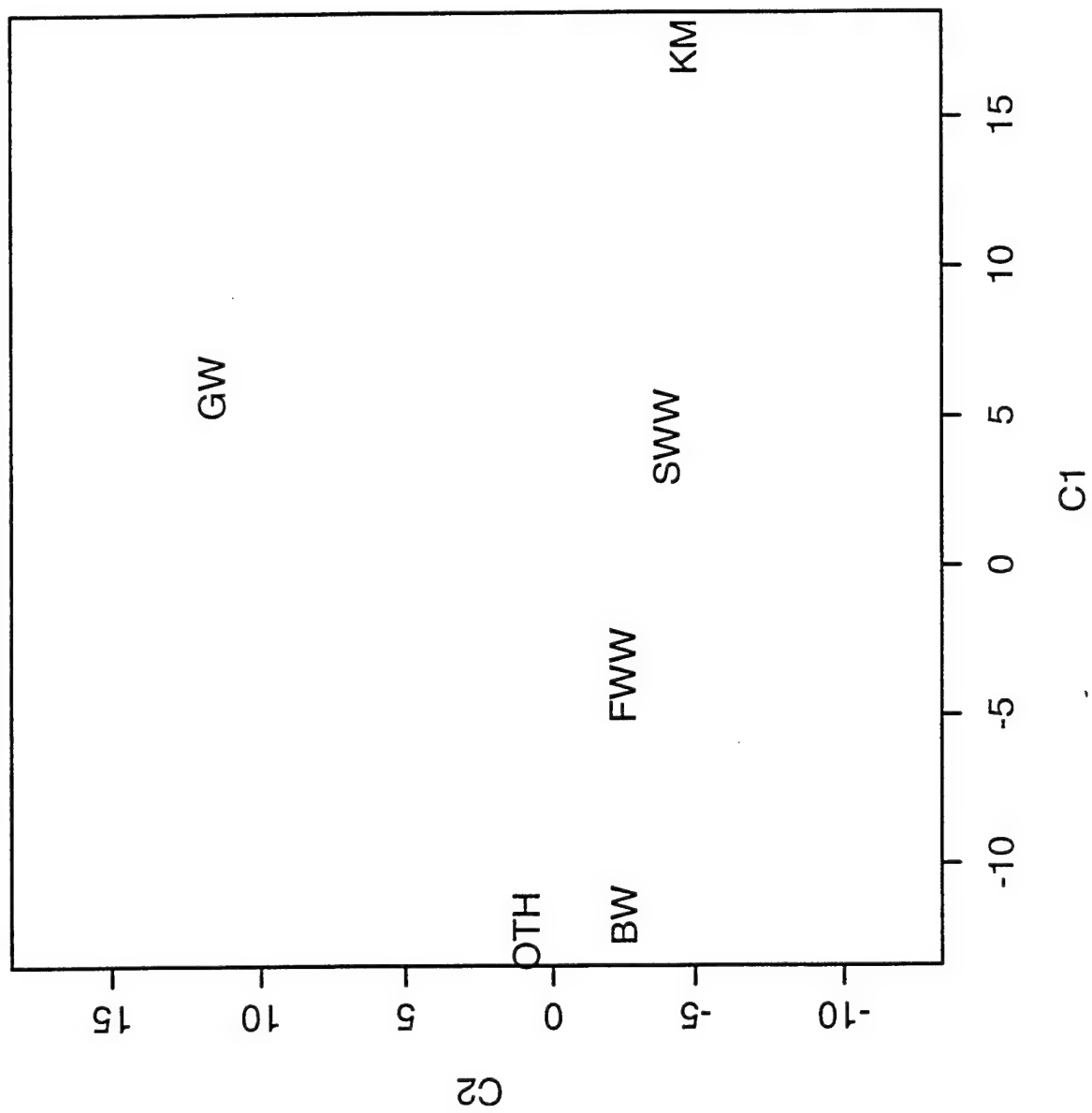
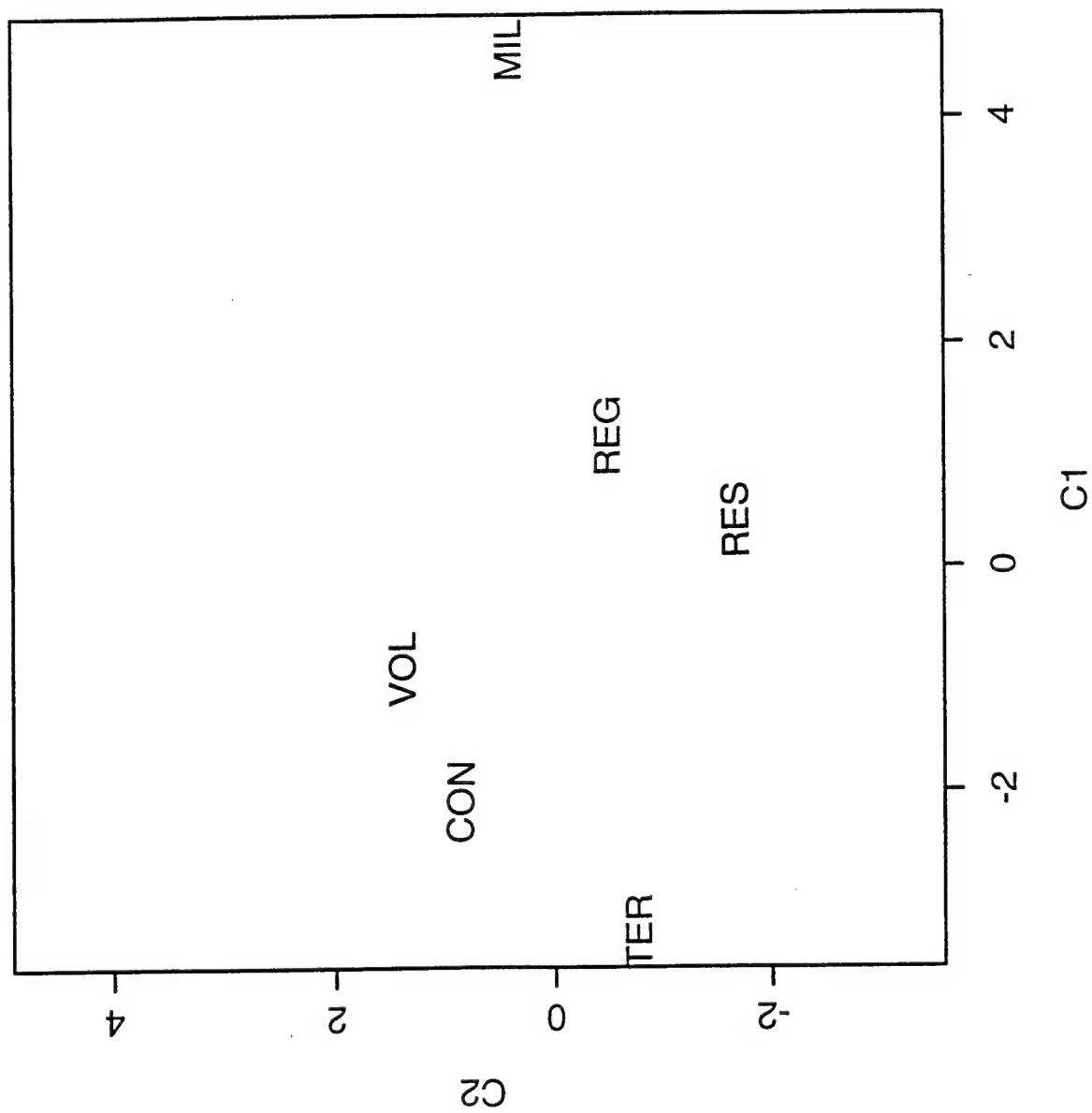


Figure 10 Plot by Type of Recruit based on Mahalanobis distances



Note: There are considerable differences in the sample sizes, the Victorian campaigns (28) and Korean/Malaya (22) being particularly small. Their positions too may not be accurately estimated in the plots. These variations may need to be taken into account in more detailed analyses.

3. Cluster analysis

It is important to compare disorders not only in terms of their severity but also in terms of their characteristic symptoms and how they relate to each other. Euclidean distance matrices between symptoms were analysed by complete linkage cluster analysis to assess the evidence for grouping these symptoms in the nine diagnostic groups (Everitt, 1993, 65-81). The analysis must be regarded as largely exploratory and descriptive.

a). Gulf-related illness

The symptoms of Gulf-related illness fell into three main groups (Figure 11).

Group 1 (10 symptoms): exhaustion, fatigue, headaches, difficulty in completing tasks, memory loss, persistent anxiety, depression, difficulty sleeping and irritability.

Group 2 (4 symptoms): shortness of breath, weight change, pains in muscles and pains in joints.

Group 3 (the remainder) including a sub-group comprising poor concentration, apathy, flashbacks and nightmares.

Interesting, 5 of the 10 symptoms in group 1 correspond to the 11 symptoms identified as factor 1 (mood/cognition) for a large Gulf War cohort (Ismail, et al, 1999, 181). Differences probably reflect the greater number of symptoms assessed in this study (94 in comparison to 52). In addition, all of the Gulf veterans believed themselves to require medical investigation, while those in the factor analysis study were randomly selected by postal questionnaire. The second factor, respiratory system, bore some relationship to group two, which includes shortness of breath. A further study identified four factors: 1. psychiatric and fatigue syndromes; 2. musculo-skeletal symptoms; 3. Gastrointestinal symptoms and 4. throat and respiratory symptoms (Wartenberg et al, 2000). Again, there is some correspondence between these and the three main groups identified by cluster analysis.

b). Effort Syndrome (WW2)

Three main groups of symptoms were identified (Figure 12).

Group 1 (8 symptoms): chest pain, dizziness, persistent anxiety, shortness of breath, rapid or irregular heartbeat, difficulty in completing tasks, exhaustion and fatigue.

Group 2 (6 symptoms): heavy sweating, depression, repeated fears, difficulty sleeping, headache and tremor.

Group 3 (the remainder) of which a sub-group of 7 symptoms were found: fainting, weakness, weight change, tenderness, pains in muscles, pains in joints and rheumatisms.

c). Psychoneurosis (WW2)

Figure 13.

Group 1a (7 symptoms): tremor, headache, difficulty sleeping, depression, anxiety, irritation and poor concentration.

Group 1b (6 symptoms): loss of interest, avoidance of social contact, exhaustion, fatigue, repeated fears and difficulty performing tasks.

Figure 11 Cluster analysis of Gulf-related illness by symptoms

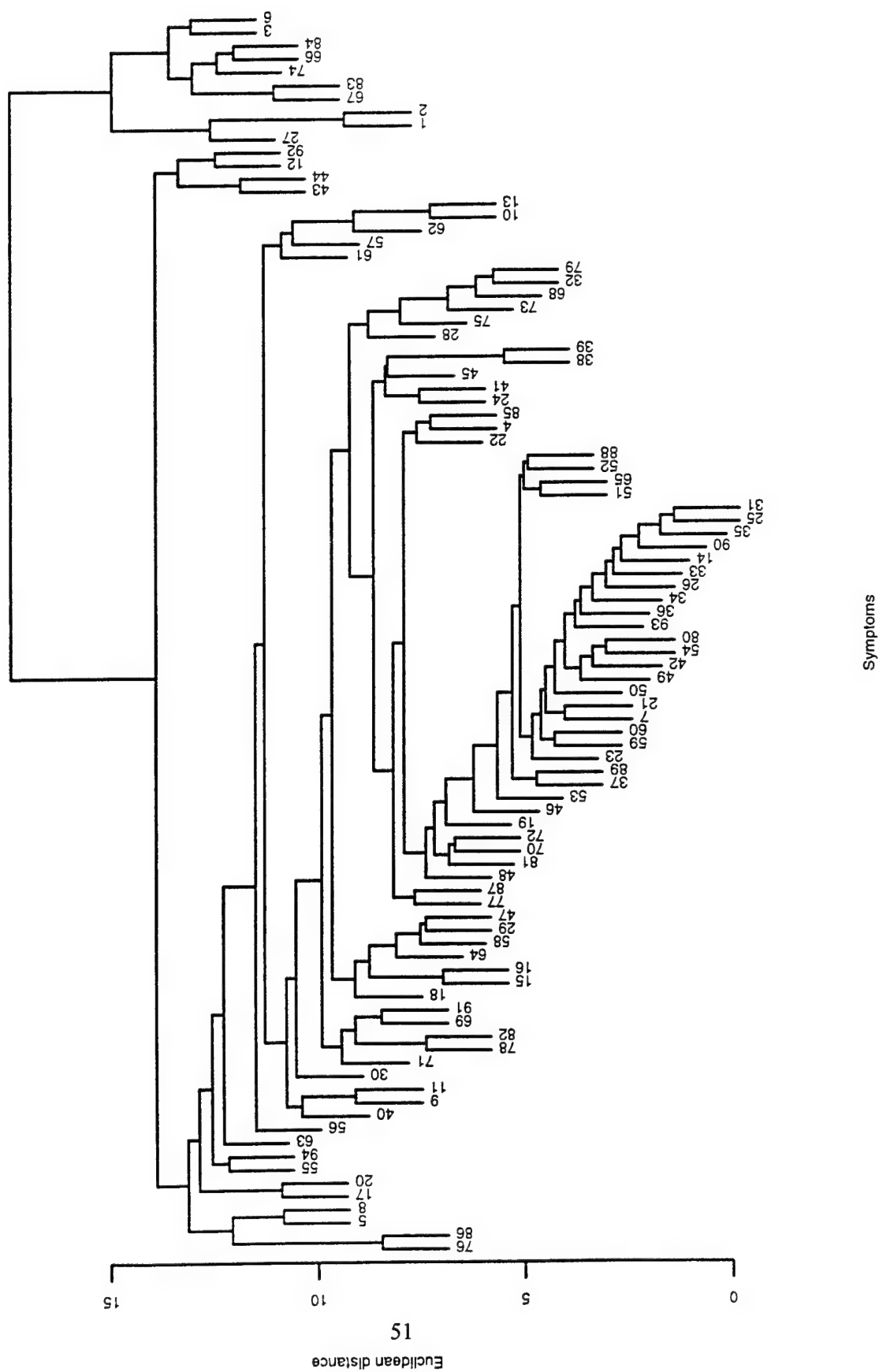


Figure 12 Cluster analysis of effort syndrome by symptoms

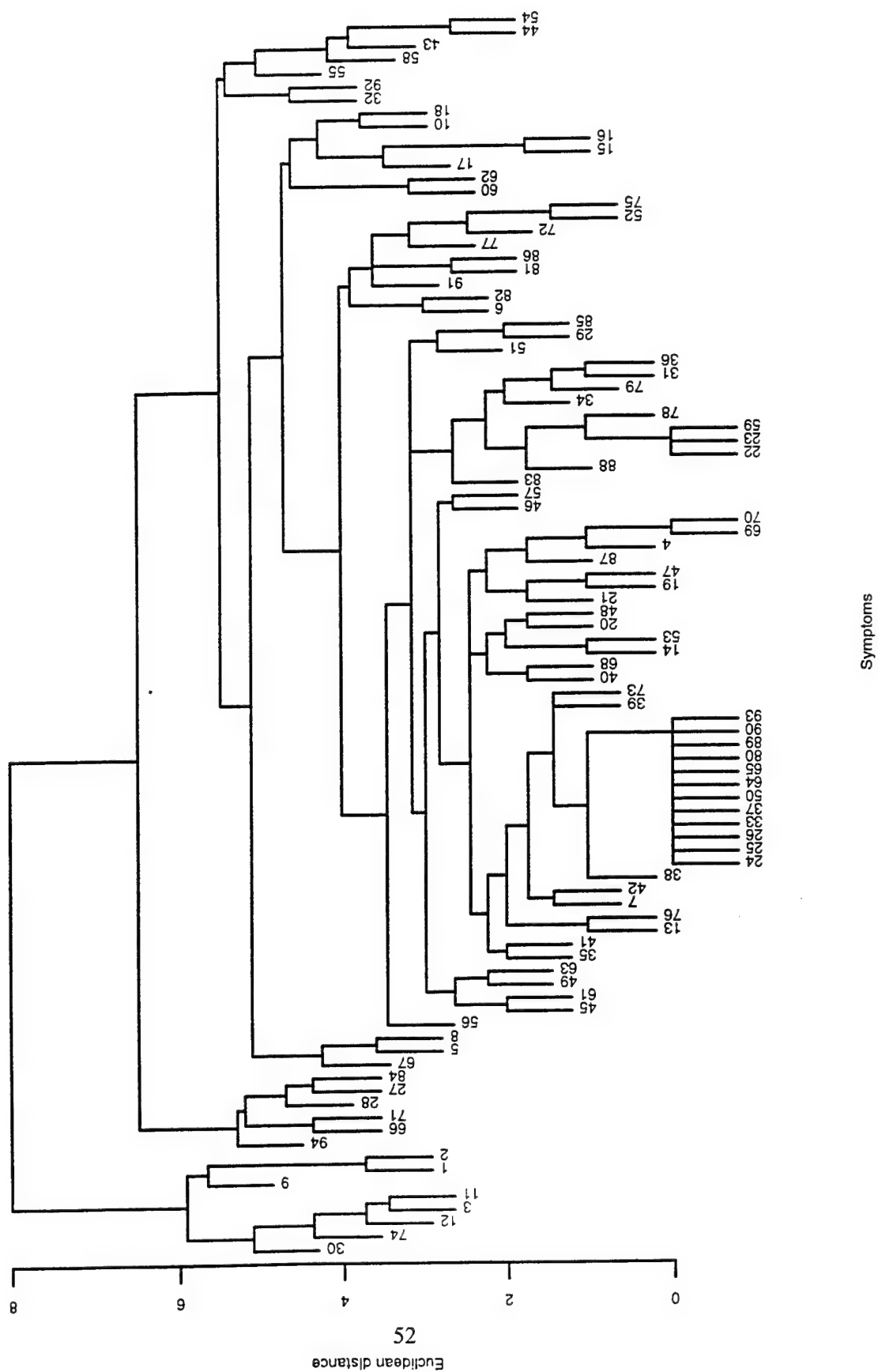
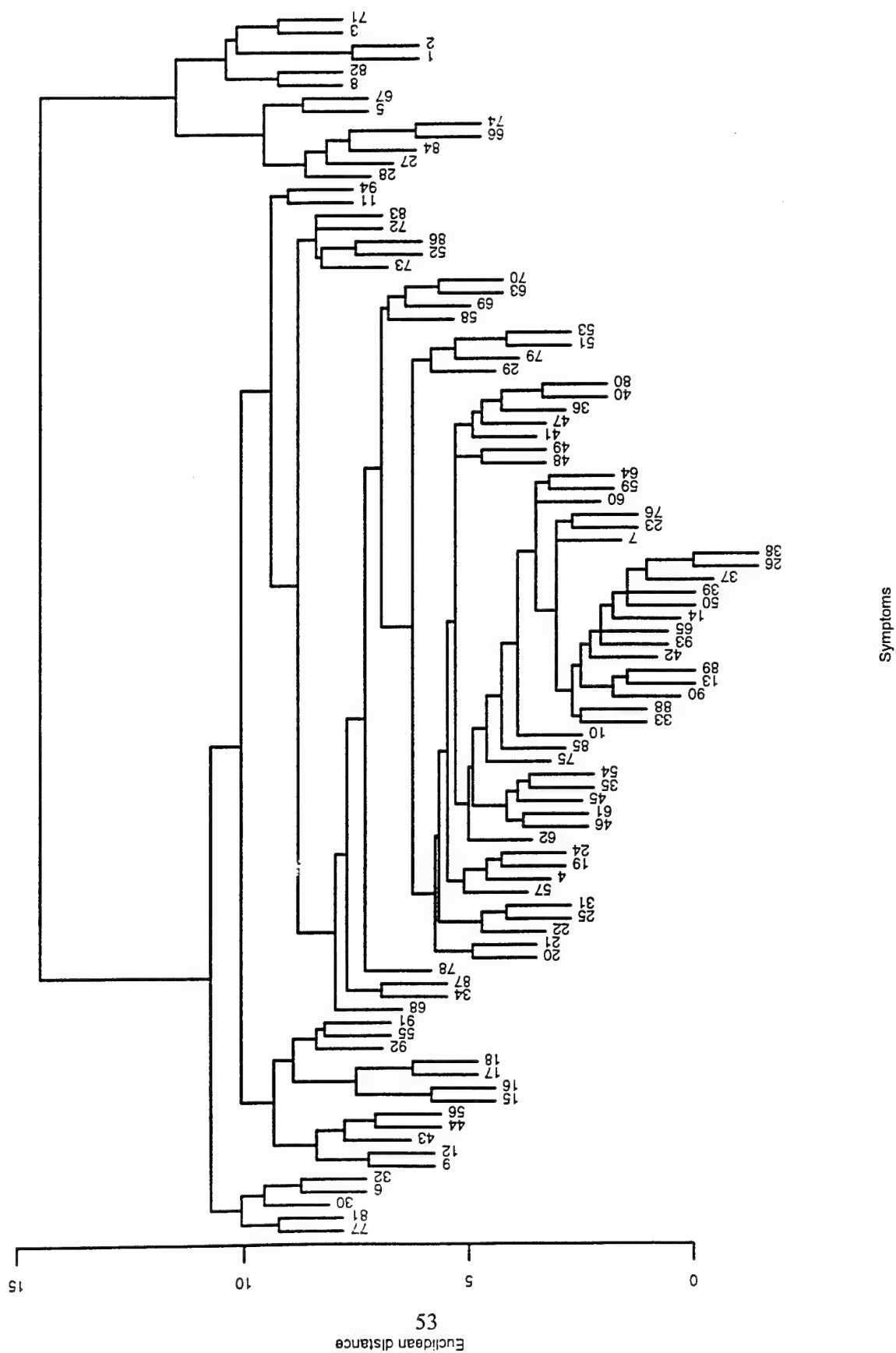


Figure 13 Cluster analysis of psychoneurosis by symptoms



Group 2a (5 symptoms): jumpiness, restlessness, dizziness, fainting, loss of memory
Group 2b (12 symptoms): chest pain, shortness of breath, pain in muscles, pains in joints, back pain, nausea, vomiting, stomach cramps, dyspepsia, weakness, loss of appetite, weight change.
Group 2c: the remainder.

d). Dyspepsia (WW2)

Figure 14.

Group 1 (10 symptoms): stomach cramps, dyspepsia, vomiting, difficulty completing tasks, weight change, anxiety, loss of appetite, flatulence, nausea and tenderness.

Group 2 (6 symptoms): headaches, dizziness, difficulty sleeping, repeated fears, depression and tremor.

Group 3 (the remainder) including a sub-group of 5 symptoms: constipation, pains in muscles, pains in joints, rheumatism and back pain.

e). DAH (Boer War and WW1)

Figure 15.

Group 1 (8 symptoms): weakness, exhaustion, fatigue, dizziness, difficulty completing tasks, chest pain, rapid heartbeat, shortness of breath.

Group 2 divided into three sub-groups.

Group 2a (2 symptoms): tremor and anxiety.

Group 2b (4 symptoms): weight change, fainting, headaches and difficulty sleeping.

Group 2c (1 symptom): rheumatism.

Group 2d (the remainder).

f). Neurasthenia/Shell Shock (WW1)

Figure 16.

Group 1 (9 symptoms): difficulty completing tasks, difficulty sleeping, tremor, anxiety, headache, depression, dizziness, repeated fears and jumpiness.

Group 2 (6 symptoms): chest pain, rapid heartbeat, shortness of breath, exhaustion, fatigue and weakness.

Group 2a (6 symptoms): irritability, increased sensitivity to noise, dreams of war, nightmares, poor concentration and memory loss.

Group 2b (the remainder).

g). Rheumatism (Boer War)

Figure 17.

Group 1 (8 symptoms): exhaustion, fatigue, pains in muscles, pains in joints, stiffness in joints, difficulty completing tasks, rheumatism and weakness.

Group 2 (1 symptom): back pain.

Group 2a (2 symptoms): tenderness and contractures.

Group 2b (3 symptoms): chest pain, rapid heartbeat and shortness of breath.

Group 2c (the remainder).

h). Palpitation/Irritable Heart/ Cardiac (Victorian campaigns)

Figure 18.

Group 1 (8 symptoms): weight change, chest pain, shortness of breath, exhaustion, fatigue, difficulty completing tasks, rapid heartbeat and weakness.

Group 2 (2 symptoms): tremor and dizziness.

Group 3 (the remainder).

Figure 14 Cluster analysis of dyspepsia by symptoms

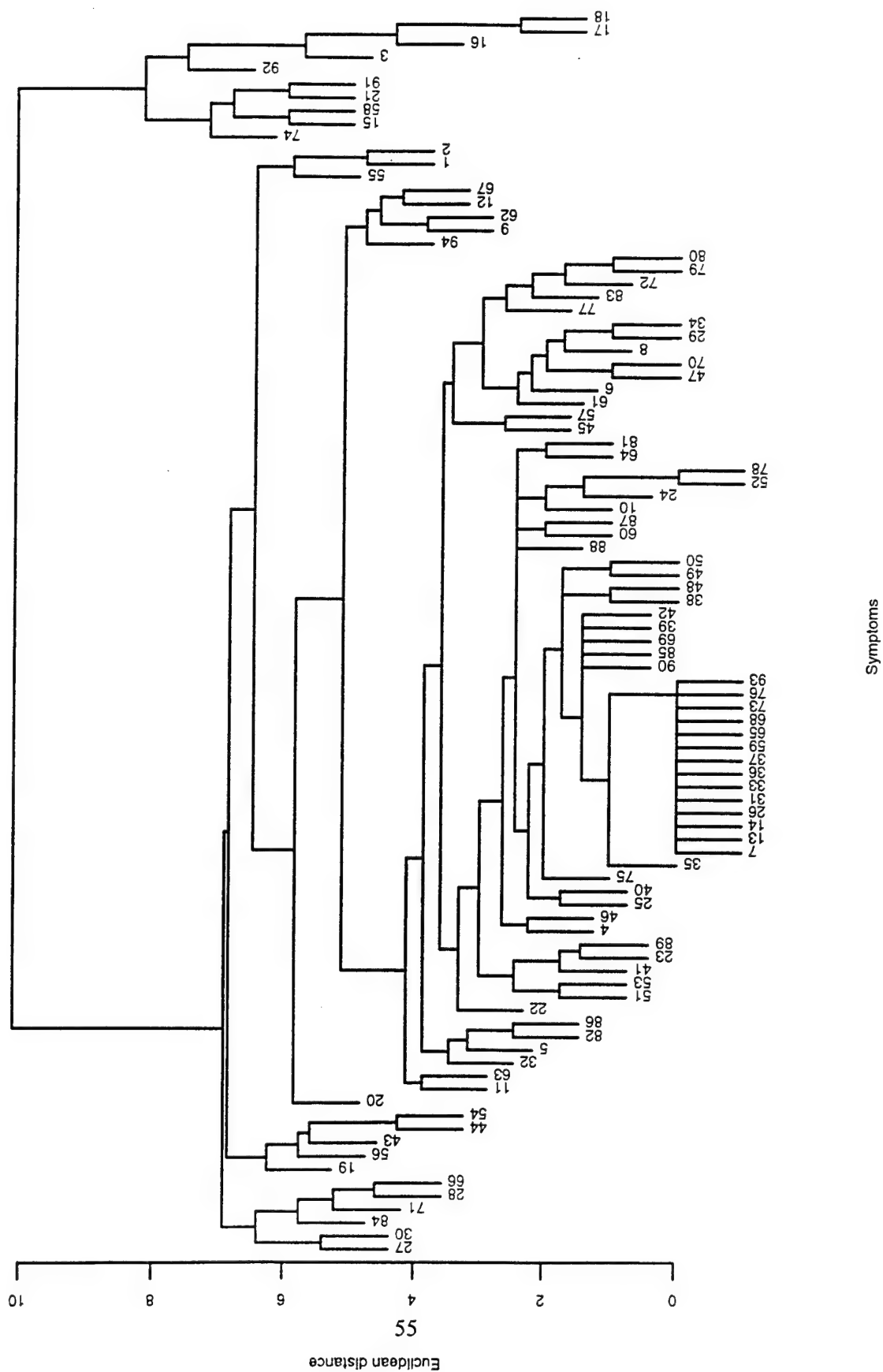


Figure 15 Cluster analysis of DAH by symptoms

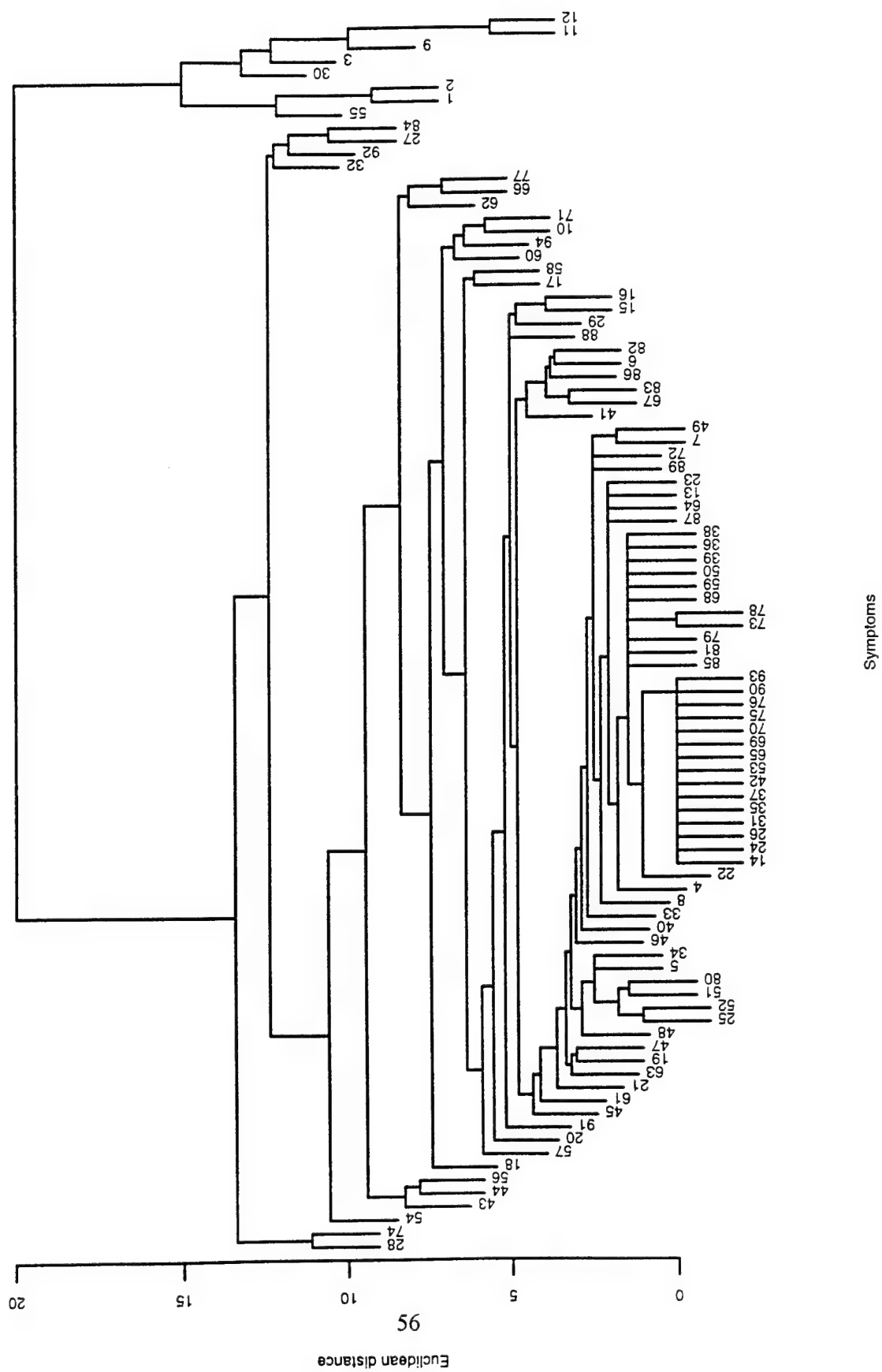


Figure 16 Cluster analysis of neurasthenia/shell
shock by symptoms

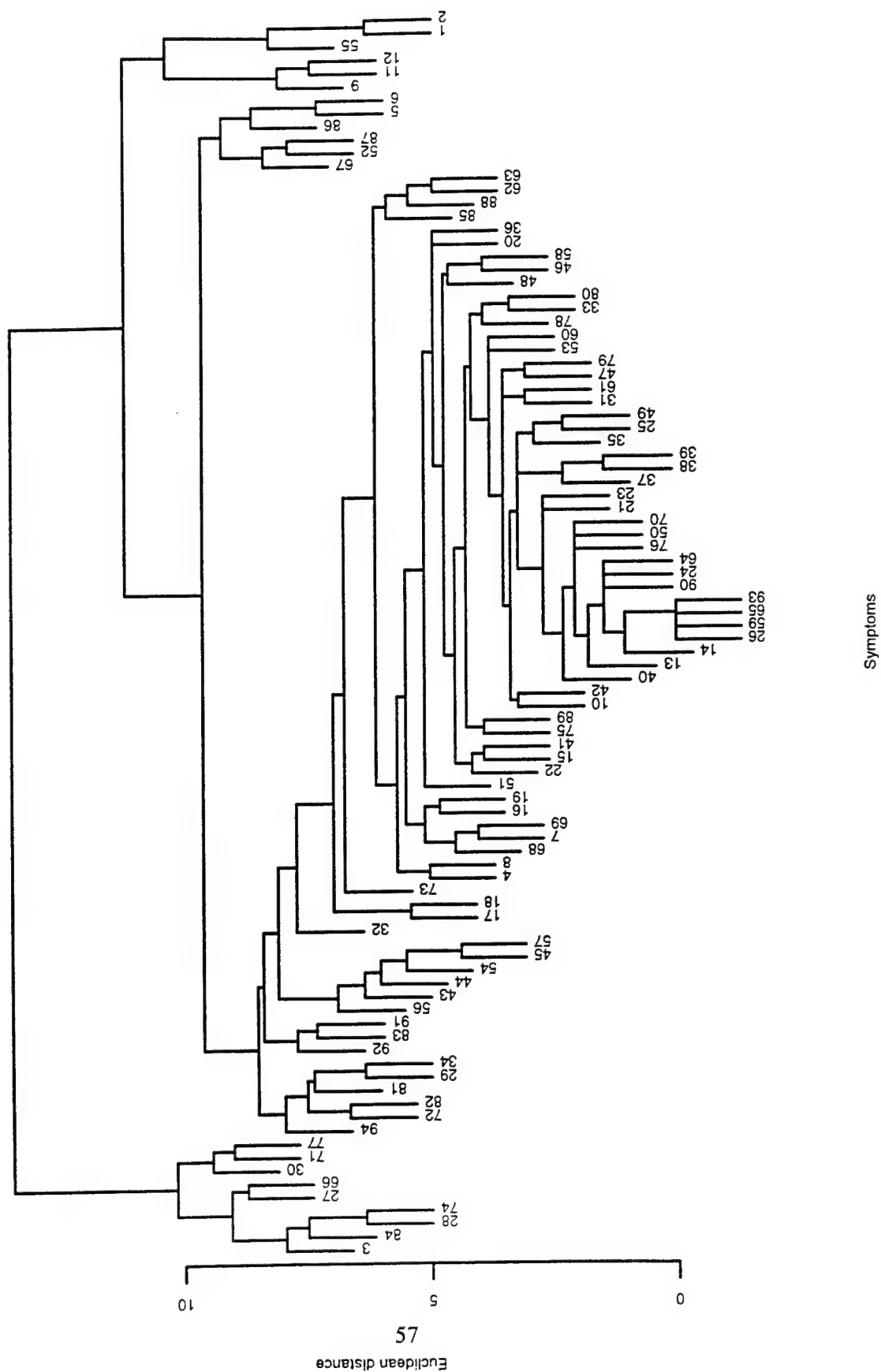


Figure 17 Cluster analysis of rheumatism by symptoms

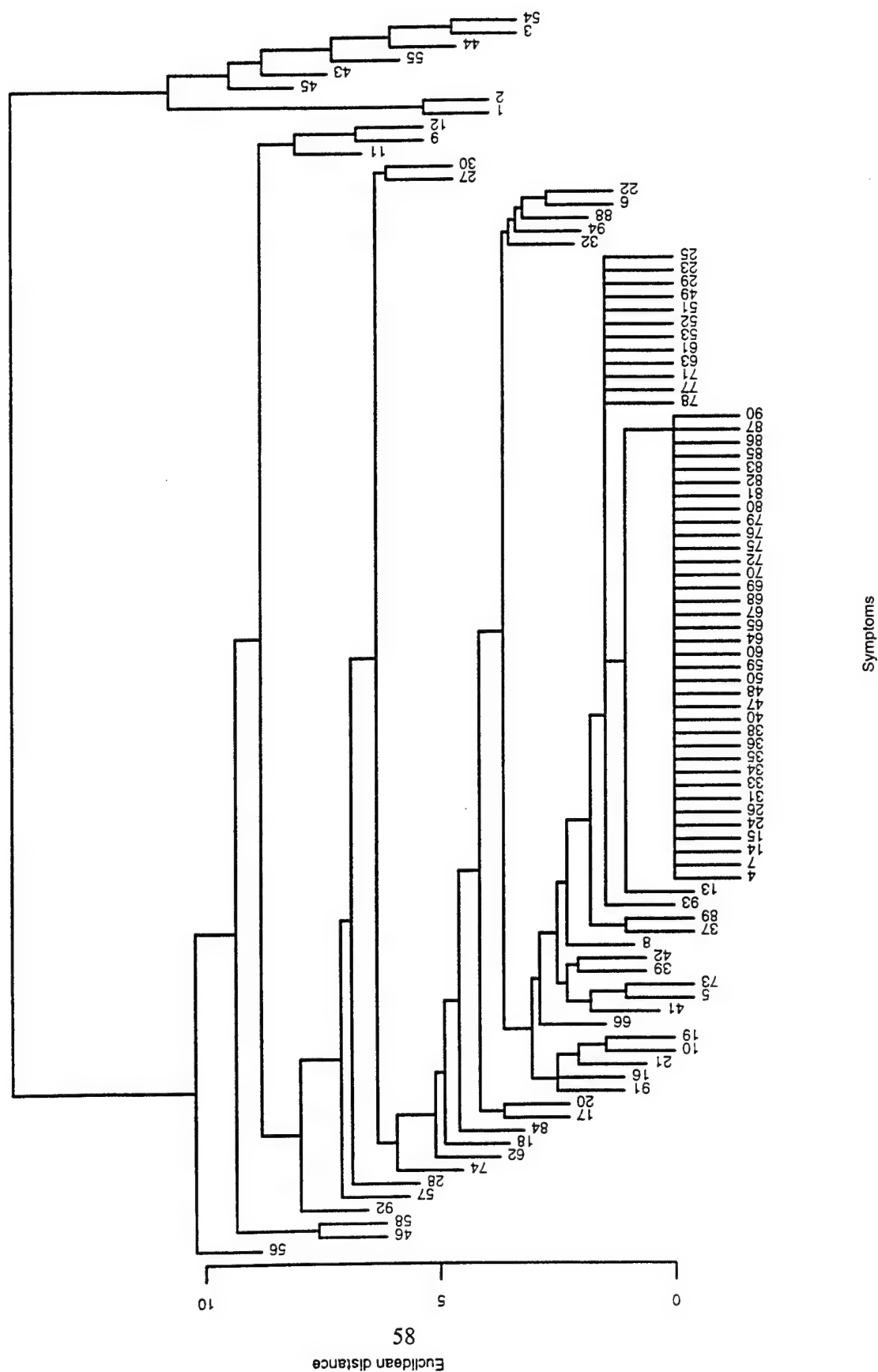
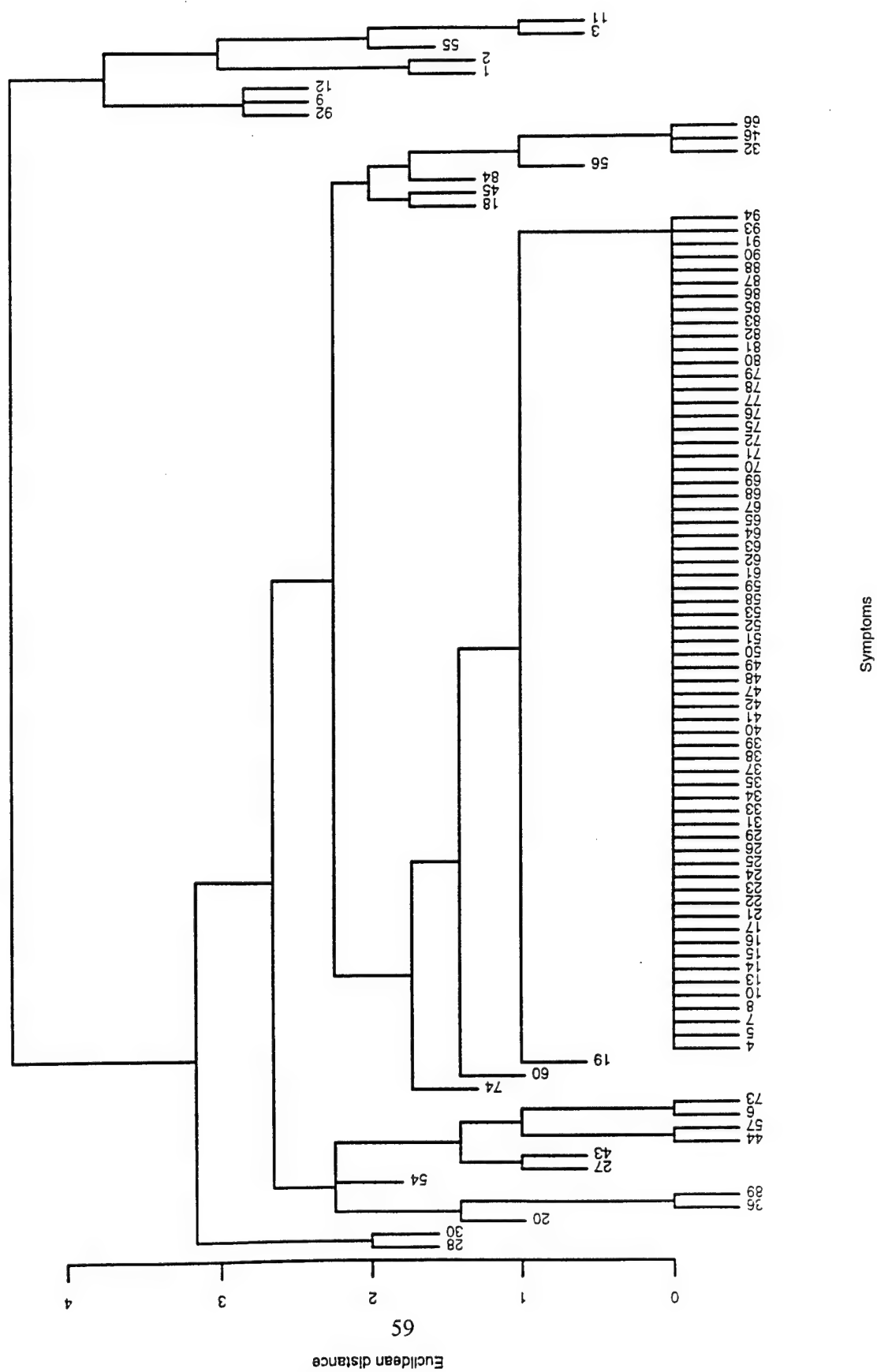


Figure 18 Cluster analysis of cardiac by symptoms



i). Debility (Victorian campaigns)

Figure 19.

Group 1 (7 symptoms): exhaustion, fatigue, difficulty completing tasks, weakness, rheumatism, pains in muscles and pains in joints.

Group 2a (5 symptoms): tremor, headaches, dizziness, back pain and anxiety.

Group 2b (the remainder).

Comparison by Diagnosis

Gulf-related illness versus effort syndrome

Judged by the mean profile, Gulf-related illness bore a close relationship to effort syndrome, psychoneurosis and neurasthenia/shell shock. It is important to compare these four disorders by symptom clusters. The three groups identified for both disorders have 12 symptoms in common: headaches, exhaustion and fatigue, anxiety, depression, difficulty sleeping, difficulty completing tasks, shortness of breath, pains in muscles, pains in joints and weight change. Effort syndrome is characterised by somatic symptoms including rapid heartbeat, chest pain, tremor, heavy sweating, tenderness and rheumatisms, while Gulf-related illness has a greater number of behavioural, cognitive and psychological signs, including flashbacks, nightmares, poor concentration, memory loss, apathy, irritability and personality changes.

Gulf-related illness versus psychoneurosis

The main clusters of Gulf-related illness compared with psychoneurosis show 15 common symptoms: headache, difficulty sleeping, depression, anxiety, irritability, poor concentration, apathy, exhaustion, fatigue, difficulty completing tasks, memory loss, shortness of breath, pains in muscles, pains in joints and weight changes. The symptoms that differ do not fall into any obvious category being both somatic and psychological. However, the bodily sensations of psychoneurosis tend to be gastrointestinal (nausea, vomiting, stomach cramps, dyspepsia and loss of appetite) which may relate to the epidemic of peptic ulcer in the armed forces during World War Two.

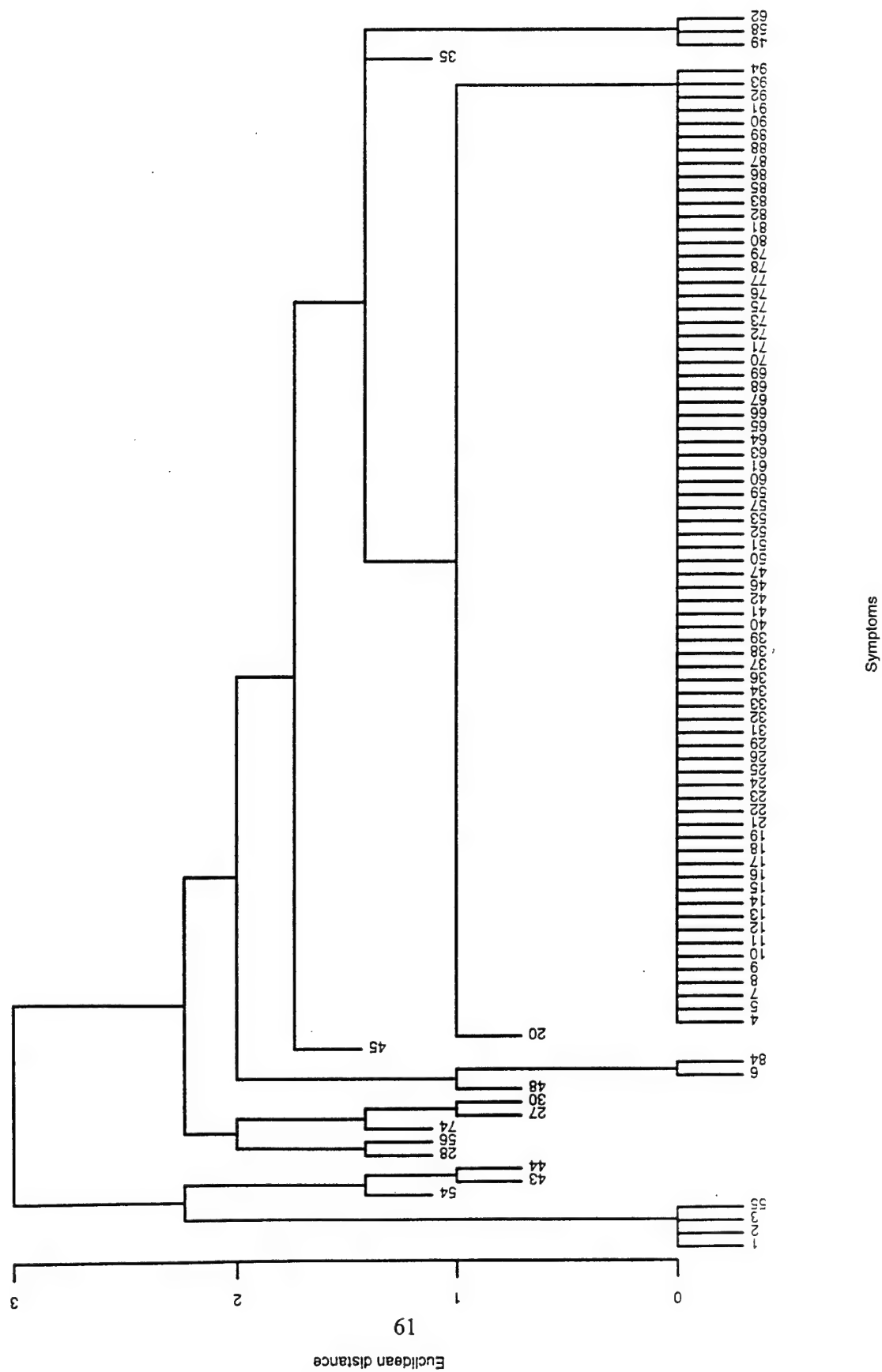
Gulf-related illness versus neurasthenia/shell shock

Thirdly, the main clusters of Gulf-related illness were compared with neurasthenia/shell shock. This revealed 11 symptoms in common: difficulty completing tasks, difficulty sleeping, anxiety, depression, headaches, exhaustion, fatigue, irritability, nightmares, poor concentration and memory loss. The somatic signs of neurasthenia were focused on the heart (chest pain, rapid heartbeat, dizziness and shortness of breath) and related to the great concern with heart disease during World War One and the high incidence of functional cardiac disorders (DAH).

Gulf-related illness versus DAH

Although they had much in common in terms of symptomatology, Gulf-related illness had less overlap with DAH. Eight symptoms were found in common: exhaustion, fatigue, difficulty completing tasks, difficulty sleeping, anxiety, weight change, shortness of breath and headaches. DAH tended to be a disorder with a clear physical focus on the heart and included: chest pain, rapid heartbeat, dizziness and fainting, together with weakness and tremor.

Figure 19 Cluster analysis of debility by symptoms



General Findings

A survey of the symptomatology of war syndromes from the American Civil War to the present identified two features that suggested a common relationship: the similarity of reported symptoms, and the high frequency of reported diarrhoea and other infectious diseases preceding the onset of these syndromes (Hyams, Wignall & Roswell, 1996, 401-02). Furthermore, it was hypothesised that war syndromes can be categorised into two groups: those that are physiologically attributed (Irritable Heart, DAH, Effort syndrome, Agent Orange exposure and Gulf War syndrome) and those that had a psychological explanation (nostalgia, shell shock, battle fatigue and PTSD). This study has confirmed that for UK servicemen, assessed by severity of symptoms, important similarities existed between Irritable Heart, DAH and effort syndrome. Yet Gulf-related illness, which has a physiological explanation, appears to have similarities with not only effort syndrome but also to neurasthenia/shell shock and psychoneurosis, both of which had a psychological attribution.

Furthermore, when assessed by their characteristic symptoms, significant differences appear to have been detected between individual war syndromes. This implies that there may not be a single war syndrome common to all modern wars. Because these disorders also have a number of symptoms in common, it suggests that they may be part of a general post-combat syndrome, which can be subdivided into a number of varieties. The forms that these take seem to be related to contemporary medical knowledge and important health beliefs and fears. At this stage in the analysis, it does not appear that there are a series of distinct war syndromes.

The second important finding is that in terms of mean profile the Gulf War seems to stand apart from the other conflicts. The other conflicts appear to stand in a temporal relationship to one another. The Victorian campaigns and the Boer War show similarities as do World War One and World War Two. The Gulf conflict seems to have a different quality. This is not a reflection of increased severity of symptoms as World War Two had equivalent or slightly higher means.

QUESTION TWO: MORTALITY STUDY

In original the submission to the Department of Defense, it was stated that we would study the morbidity and mortality of veterans from World War One. We proposed a comparison of 700 ex-servicemen diagnosed with DAH/effort syndrome with 700 pensioners suffering from loss of limb. This study was changed for the following reasons.

Veterans with DAH rarely received a pension of more than 40% and commonly 20-30%. Shell shock, or neurasthenia as it was reclassified in 1917, was regarded as equivalent to a severe wound, if likely to recover, or a very severe wound where the disability was likely to be permanent or prolonged (PRO, WO32/2791, 1917). Under the schedule drawn up in 1917, loss of two limbs entitled a serviceman to a pension of 100%, while the amputation of a single limb could carry an entitlement of 50% to 70% (*Ministry of Pensions, First Annual Report, 1919, 90-91*). As a result, it was decided to select men with minor gunshot wounds (GSW) as the control population.

The obvious source were the war pension files in the PRO (PIN26). Because these are catalogued by name and disorder, 700 random cases of DAH could be easily selected. However, the percentage disability for the GSW cases can only be discovered by requesting and searching each individual file. It would be necessary to request at the very minimum 1,500 documents to find 700 pensioners with GSWs of 20-30%. In addition, these files rarely include detailed dates of birth. Most simply recorded a year, which in some cases was falsified by under-age recruits. Under financial constraints from government, the Ministry of Pensions withdrew most pensions in the 1920s and 1930s when the file was closed. As the veteran was still youthful, the documents very rarely contain a date of death. Indeed, of the 200 DAH cases in the symptom study, only 13 (6.5%) had details of when the servicemen died.

It is virtually impossible to find the date of death from the name alone. Death certificates are indexed alphabetically by year at the Family Records Centre (managed by the Public Record Office and Office for National Statistics). With no indication of when an ex-serviceman might have died, it is necessary to consult as many as 50 volumes with no certainty of finding the former pensioner. As a result, it was not possible to use the 200 DAH cases from the PIN26 holding in an investigation of mortality and morbidity.

Because DAH and neurasthenia are both functional disorders, they are not listed in national statistics as official causes of death. It is not possible, therefore, to approach the problem from an institutional direction rather than individual cases. The only way to discover more about the mortality of servicemen with war syndromes is to look at case records, which are problematical for the reasons given above.

At the DSS filestore in Nelson, Lancashire, we discovered an archive of 7,800 World War One pension files. These included all 13 regions of the UK and Ireland. The records are comprehensive, containing dates of birth, dates of death and in many cases death certificates. We randomly extracted two groups (DAH and neurasthenia/shell shock) together and equivalent number of GSWs matched by region, rank and level of disability. There are 139 cases of DAH and 126 of neurasthenia/shell shock. Not all the files included death certificates and full dates of death. It was necessary to research these at the Family Records Centre and then to purchase death certificates from the General Register Office in Southport. This was added to an already time-consuming process, and in total 197 death certificates were bought at a total cost of £1,280.50.

Once these groups were examined in more detail, it became apparent that this population is self-selected. They represent the last World War One cases to be administered by the DSS and refer to the longest-lived veterans (with a small number who died earlier but whose widow was entitled to a pension). They are not representative of the entire World War One pension population. They have been put into an Access database and coded using the 10 most common causes of death in the US in 1982: heart disease, cancer, accidents, stroke, chronic lung disease, suicide, pneumonia/influenza, chronic liver disease, diabetes mellitus, and other.

Given the problems with the World War One archives, it was also decided to undertake a mortality and morbidity investigation of Boer War pensioners. The two samples (200 cases of DAH and 200 cases of rheumatism) from the symptom study

were used as most of these files contained dates of birth and death and details of cause of death. A random selection of Boer War veterans with gunshot wounds was collected and matched by rank and level of disability on discharge. Although the population is representative in terms of geographical spread and non-commissioned ranks, it does not contain any officers. Like the Nelson sample, it is drawn from a long-lived group of pensioners. The average ages of the two groups (68.2 for DAH and 70.6 for rheumatism) suggests that as servicemen died their files were destroyed, leaving a residual collection of the healthier ex-servicemen. The two samples of 200, matched with equivalent gunshot wound cases, have been entered in a database. We are unable as yet to present the analysis as the search for missing death certificates continues. It has to be emphasised that the two mortality studies, though not ideal in their design, are all that the surviving historical records will permit.

Statistical Analysis

The study of World War One veterans focused on two randomly-selected samples: 126 cases of neurasthenia/shell shock and 139 cases of DAH. Each group was matched with veterans who had been awarded a pension for a minor gunshot wound. The matching was by both percentage disability and region. Cause of death, where known, was coded for comparison. The average ages at death for the four populations were calculated (Table 30).

Table 30 Mean Ages at Death by Diagnosis

Groups	Mean	Number	Standard Deviation
DAH	85.11	139	8.97
DAH controls	89.74	139	9.06
Neurasthenia	89.83	126	9.47
Neurasthenia controls	89.03	126	9.74

Comparison of paired ages at death by t-test showed that there was a significant reduction in life expectancy for the DAH sample ($t = -4.50$, d.f. = 138, $p < 0.005$). No significant difference could be detected between the neurasthenia sample and their controls (Table 31). A non-parametric Wilcoxon test, rather than the t-test (which assumes normal distribution), gave similar results. The mean rank for the controls versus the DAH sample is 74.04 giving an asymptotic z-score of -5.183 and a p value of < 0.005 . The corresponding results for the neurasthenia sample are 61.79, a z-score of -0.26 and p value of 0.79.

Table 31 Paired Samples by t-test

Paired samples t-test	DAH v. Controls	Neurasthenia v. controls
Mean	-4.63	0.80
Standard deviation	12.15	13.28
Standard Error Mean	1.03	1.18
95% Confidence Interval	-6.67 to -2.60	-1.54 to 3.14
T	-4.50	0.68
Degrees of freedom	138	125
Significance (2-tailed)	< 0.005	0.49

It is difficult to explain what appear to be conflicting results. First, the samples are small and randomly selected from an unrepresentative group of World War One veterans. The reduced life-expectancy of the DAH pensioners does not appear to have been the result of undetected cardiac disease. Death from heart disease in the DAH group was not significantly greater than the controls (Table 33). The most likely explanation is that there was a bias introduced by the physicians appointed to assess the veteran's disability. By 1918, DAH was widely recognised as a functional disorder, while shell shock was considered an honourable outcome of battle and at one time entitled the sufferer to wear a wound stripe. It has already been shown (Table 18) that in practice pensions for neurasthenia/shell shock tended to be more generous than those for DAH. It is possible, therefore, that physicians were less sympathetic to servicemen with a diagnosis of DAH and granted them lower percentages. Accordingly, their disabilities may have been under assessed in comparison with other pensioners, and this, in turn, may explain why their life expectancy was shorter. As a result, it is proposed to repeat the DAH study with controls matched not at the same level of disability but with slightly higher percentages to test whether systematic bias existed in the assessment programme.

Table 32 Cause of death for the Neurasthenia cohort

Cause of death	Neurasthenia (n = 126)	GSW (n = 126)
Heart disease	36 (28.6)	44 (34.9)
Cancer	9 (7.1)	14 (11.1)
Accident	3 (2.4)	2 (1.6)
Stroke	11 (8.7)	16 (12.7)
Chronic lung disease	6 (4.8)	3 (2.4)
Suicide	0	0
Pneumonia/influenza	21 (16.7)	19 (15.1)
Chronic liver disease	0	0
Diabetes mellitus	0	0
Other	6 (4.8)	11 (8.7)
Not known	34 (27.0)	17 (13.5)

Table 33 Cause of death for the DAH cohort

Cause of death	DAH (n = 139)	GSW (n = 139)
Heart disease	49 (35.3)	46 (33.1)
Cancer	15 (10.8)	11 (7.9)
Accident	0	1 (0.7)
Stroke	8 (5.8)	10 (7.2)
Chronic lung disease	2 (1.4)	8 (5.8)
Suicide	0	0
Pneumonia/influenza	17 (12.2)	27 (19.4)
Chronic liver disease	0	0
Diabetes mellitus	0	0
Other	6 (4.3)	9 (6.5)
Not known	42 (30.2)	27 (19.4)

As regards cause of death, simple cross tabulation of the two groups with their equivalent controls shows no obvious pattern of difference. However, many of the cells are empty and there is much missing data. Chi-squared analysis was not possible since so many of the cells have very small expected values. At present, the sample sizes are too small to permit any form of powerful comparison.

Key Research Accomplishments

In the three years of this study, the key research accomplishments are as follows:

- The identification of important primary sources some of which are not open to public scrutiny and have never before been the subject of systematic study.
- The design and completion of the first historical database of war syndromes. Although a number of papers have addressed the issue of post-combat syndromes in the past, they were based on secondary sources and contemporary accounts. This is the first statistically-validated study of their symptomatology and incidence using primary sources.
- The project makes use of advanced statistical methods, including cluster analysis, to reinforce the quantitative evidence that has been presented.
- The study represents an important addition to knowledge about war syndromes: their essential characteristics, and those servicemen who suffered from them.
- This information has implications for treatment strategies and preventative measures.

Reportable Outcomes

1. Publications and manuscripts

We have already published a number of subsidiary or related studies; they include:

Jones, E. and Wessely, S. (1999) Case of chronic fatigue syndrome after Crimea war and Indian mutiny. *BMJ* 2: 1645-57.

Jones, E. and Palmer, I. (2000) Army Psychiatry in the Korean War: the experience of 1 Commonwealth Division. *Military Medicine* 165: 256-60.

Jones, E. and Wessely, S. (2001) The impact of total war on the practice of British psychiatry. In R. Chickering and D.S. Mattern, *The Shadows of Total War, Europe, East Asia and the United States 1919-1939*. Cambridge: Cambridge University Press (in press).

Jones, E. and Wessely, S. (2001) Psychiatric battle casualties: an intra- and inter-war comparison. *British Journal of Psychiatry* 178: 242-47.

Jones, E. and Wessely, S. (2001) The origins of British military psychiatry before the First World War, *War and Society* (submitted).

Jones, E., Palmer, I. and Wessely, S. (2001) War Pensions 1900-1945: A barometer of health beliefs and psychological understanding, *History of Psychiatry* (submitted).

2. Presentations

The study and various aspects of its design have been presented at a number of conferences by Dr Edgar Jones. These included:

- a) Tri-Service Psychiatric Conference, Royal Defence Medical College, Gosport, in October 1997: a presentation on the history of war syndromes to psychiatrists and psychiatric nurses from all three services.
- b) Conference organised by the Institute of Medicine to inform the principal investigators of 'Strategies to Protect the Health of Deployed US Forces' in July 1998: presentation on the history of war syndromes.
- c) Thirteenth Conference on Military Medicine at Washington in May 1999, which addressed 'Unexplained Symptoms after War and Terrorism, Building towards a Consensus': Edgar Jones chaired the Social Science Research panel and served on the Consensus Committee.
- d) International conference at the University of Southampton on 'Memories of Catastrophe' (after war, natural disasters and atrocity) in April 2000: a presentation on the psychological impact on military psychiatrists who had treated servicemen with war syndromes.
- e) Royal College of Psychiatrists Annual Meeting in July 2000: presentation on the history of war syndromes for the New Research Section on 'Armed Forces, Conflict and Mental Health'.
- f) The forthcoming Royal College of Psychiatrists Annual Meeting in July 2001: presentation on 'The birth of military psychiatry: its pre-1914 history in the UK'.

Conclusions

Modern wars, often involving periods of intense fighting, produce disorders for which no clear organic cause can be found. War syndromes are expressed by similar clusters of medically unexplained symptoms. These tend to be non-specific and are both physical and psychological. Among bodily sensations, the following are important: breathlessness, fatigue, dizziness, headache, difficulty in sleeping, joint stiffness and chest pain. Psychological signs include persistent anxiety, depression and feeling distant or cut off from others.

Although similar symptoms recur after most major conflicts, individual wars generate their own physical focus, diagnostic terms and explanations. The American Civil War produced irritable heart or Da Costa's syndrome. In the UK, campaigns fought in the mid- and late-nineteenth century witnessed the use of terms such as palpitation and debility. The Boer War saw DAH and rheumatism as significant causes of medical discharge from the armed forces. World War One led to diagnoses of shell shock and the new term effort syndrome was coined by Thomas Lewis in 1917. During World War Two dyspepsia and suspected duodenal ulcer were often the cause of men being invalided from the services. The physical focus of war syndromes appears to be closely related to the dominant health concerns of the period.

This study suggests that it is not always possible to divide war syndromes into two broad groups: those with a strong physical dimension (DAH, Effort syndrome, dyspepsia and rheumatism), and those with a psychological explanation (shell shock, neurasthenia, psychoneurosis, PTSD). For example, the symptom clusters of neurasthenia and effort syndrome appear to have much in common.

A comparison between a sample of Gulf War veterans suffering from Gulf-related illnesses and various earlier war syndromes has shown significant similarities with neurasthenia/shell shock, effort syndrome, cases of psychoneurosis from World War Two and DAH.

War syndromes affect combat, combat support and non-combatant troops alike, and in roughly the proportions that they exist in the armed forces. Rank is not a protector, though in recent years NCOs appear to suffer disproportionately, while officers seem to experience fewer symptoms. As regards military conduct, servicemen with these disorders tend to have good disciplinary records; they are not malingerers or repeat offenders.

Attributions presented by servicemen have varied considerably over the last century. In part, they appear to be culturally determined, reflecting contemporary health beliefs and the state of medical and military knowledge. Explanations ranged from external physical factors (intemperate climate or chemical exposure) through to internal psychological conflict (stress of battle or worry of family circumstances).

In many cases war syndromes were preceded by a wound or recognised illness (commonly influenza, pneumonia or fever). Although the symptoms of the subsequent disorder were not always the same, the hospitalisation and earlier experience of being ill appears to have served as a framed subsequent bodily sensations and behaviour.

So what then are the implications of these findings? Why is it important to understand more about war syndromes, their nature and who suffers from them? First, they have arisen after most major wars over the last century, and they are therefore likely to continue to appear in varied forms. Secondly, they are pensionable disorders. In the past, when largely untreated, they cost governments considerable sums in financial compensation. If preventative measures are to be put in place and effective treatments devised, it is necessary to know which troops are at risk and what interventions are most likely to address these disorders. If each new war syndrome is not seen as a unique and novel illness, but as part of an understandable pattern of responses to war, then it may be managed in a more effective manner.

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Appendices

Contextual Archival Research

(i) At the Public Record Office: the archives of the Ministry of Pensions, the War Office and the Prime Minister's Office have been surveyed, and the following files investigated:

a). *From the former Ministry of Pensions* (Class PIN).

53-58 Minutes of the board for the treatment of neurasthenia (shell shock) from 1917-1933.

2208 Neurasthenia, definition of nervous shock and war injury(1939-44).

2399 Neurasthenia and psychoses: treatment and entitlement to pension (1939-42).

2400 Neurasthenia treatment and pension rights (1943-44).

2401 Report of the Committee on Neurasthenia (1939).

2402 Inter-departmental action on the report of the Neurasthenia Conference (1939-40).

2403 Standing Committee on neurosis in wartime: appointment of sub-committee, minutes of meetings, report to minister (1940-42).

2404 Joint Committee on Neurosis in Service Cases (1940-41).

2405 Neurosis attributable to war service: treatment of men discharged from services (1941-42).

4039 The effects of gas poisoning in the First World War on eyesight (keratitis) and its physiological impact (1937-38).

4040 Neuroses, psychoses etc. translations of papers from German (1953).

b). *From the War Office archives* (Class WO).

32/2791 Classification of War Wounds according to their severity (1917)

32/2792 Classification of War Wounds, incorporating the findings of the specially constituted committee (1920)

32/2793 Post-war disability pensions supplementary recommendations after discharge (1921-22).

32/4747 War Office Committee of Inquiry into Causation and Prevention of Shell Shock: minutes and correspondence relating to the setting up, membership, terms of reference and conduct of the Committee (1920-22).

32/4748 Report of the War Office Committee of Inquiry into Shell Shock (1922)

32/6183 Report by the Raglan Committee and memorandum by Lord Stanley on Disability Pensions (1901)

32/11222 Report of the Baldwin Committee on Disability Pensions (1919-22)

32/11400 Report of the Disability Pensions Committee (1920-21)

32/11972 Use of Psychologists and Psychiatrists in the Services – Enquiry by Lord Privy Seal (1942-46)

32/11973 An interim report from the Ministerial Committee on the Work of Psychologists and Psychiatrists in the Services (1943-44)

32/11974 Work of Psychologists and Psychiatrists in the Services: minutes of meetings and policy statements (1946-47)

32/13462 Army Psychiatry Advisory Committee, minute sheets, correspondence and details of meetings (1945-66)

33/199 Report of the Committee on Disability Pensions chaired by Lord Raglan (1901)

33/247 Report of the Committee on revised regulations for Wounds and Injury Pensions (1902)

108/129 South African War return of invalids (1902)

108/165 RAMC Reports on servicemen in South Africa (1901-02)

108/390 General Sir W.D. Wilson, *Report on the Medical Arrangements in the South African War*, London: HMSO (1904).

222/8 Notes on the administration of Army psychiatry (1939-43)

222/103 Return of all psychiatric patients seen in all commands (1942)

222/846 Reports of the work of the Medical Division of Military (P) Hospital, Northfield, Birmingham (July 1943-January 1944).

222/2151 Medical History of the Second World War: Army Medical Services statistical returns by command and disorder (1939-45)

c). *Prime Minister's Office* (PREM 4)

15/2 Correspondence and minutes from the enquiry set up to investigate the role of psychiatrists and psychologists in the Army (1942-44).

(ii) At the Department of Social Security's archive in Nelson, Lancashire:

Historical texts from the former Ministry of Pensions library have been studied. These include the 39 issues of *The War Pensions Gazette*, first published in May 1917 and discontinued in July 1920. This was a semi-official journal, published monthly by His Majesty's Stationary Office. It was aimed at staff of the Ministry, members of the local pension boards and pensioners themselves. Costing two old pence, the *Gazette* gave advice on rehabilitation, treatment and legal issues and provided details of parliamentary debates. Other texts and reports include *Comparative Tables* (1919), *Reports made to the Prime Minister by the British Legion* (1938), Devine and Brandt (1919), McMurtrie (1918), Peterson (1930), and Sherren (1921).

(iii) At the Wellcome Institute for the History of Medicine in the Contemporary Medical Archive Centre:

The papers of physicians and psychiatrists, including

Sir Thomas Lewis (1881-1945), cardiologist working with troops suffering from DAH (PP/LEW).

Sir William Sargent (1907-1988), psychiatrist at Sutton Emergency Hospital (PP/WWS).

Dr S.H. Foulkes (1898-1976), psychiatrist at Northfield Military Hospital (PP/SHF).

Charles Wilson, Lord Moran (1882-1977), regimental medical officer during the First World War and author of a study on the nature of courage (PP/CMW).

Dr S.H. MacKeith, RAMC psychiatrist and medical superintendent of Napsbury Mental Hospital, St Albans (GC/135).

The Royal Army Medical Corps Muniment Collection (RAMC).

(iv) The National Army Museum: official regimental histories and publications together with contemporary accounts by servicemen of their experiences at war have been researched to fill gaps and provide supplementary information for the database.

(v) The Imperial War Museum, Sound Archive: 28 interviews of servicemen and RAMC physicians and psychiatrists have been transcribed relating to the First World War, Second World War and Korea. These accounts are an invaluable record of personal experiences.

Specimen of the standardised questionnaire (HMR) for each subject

King's Research Unit into Combat Syndromes (KRUCS)

HISTORICAL MEDICAL RECORD

CASE NUMBER: WAR CODE: SUBJECT/CONTROL:

INVESTIGATOR: LOCATION: DATE:

PIN NUMBER: NAME:

1. Biographical Details

Date of Birth Date of Death
Male Female Cause of Death:
Marital Status
Siblings
Children
Education: school qualifications others
Occupation before military service
Occupation after military service
Family history of illness
History of illness before service
Known smoker Alcohol

2. Pension Awards

When pension awarded Main diagnosis:
Multiple diagnoses:
Attributed/due to: Aggravated by: Nil:
Per cent disability awarded
Increments or reductions (with diagnoses)
Pension ended
Reason why pension ended

3. Military Record

Military status:

Regular
Militia
Territorial
Volunteer
Conscript
Re-enlisted
Pre-war service

Rank on leaving service
Regiment or Corps
Date of enlistment/conscription
Place of enlistment Place of Birth
When deployed overseas
Date of discharge/demobilisation
Theatre of operations

Military role:

Combat
Combat support
Non-combatant
Job
Engaged in combat (time periods)

Subjected to:

Gas attack
Explosion
Burial
Wounds
Fire attack
Other trauma

II. SYMPTOM LIST

Record with a tick if reported in medical notes.

1. Fatigue

Exhaustion (always tired)
Fatigue, lethargy or stupor
Difficulty in completing tasks
Feeling un-refreshed after sleep

2. Cognition

Poor concentration
Forgetfulness (or memory loss)
Exhaustion after reading or emotion
Apathy (lack of feeling or interest)

3. Cardiovascular and Respiratory Systems

Chest pain
Tightness in chest
Rapid or irregular heart beat
Shortness of breath (difficulty in breathing deeply)
Wheeze
Faster breathing than normal

4. Gastro-intestinal System

Nausea
Vomiting
Stomach cramps and abdominal pain
Dyspepsia or persistent indigestion
Constipation
Diarrhoea
Flatulence or burping

5. Genito-urinary

Passing urine more often
Pain or difficulty in passing urine
Sexual problems (including impotence)
Nocturnal enuresis
Incontinence of sperm

6. Central Nervous System

Headaches
Tremor, shaking or trembling
Twitching or spasmodical jerks
Dizziness or giddiness
Tics

Fainting (loss of consciousness)
Fits or convulsions
Stammer
Loss of voice (aphonia)
Difficulty in producing sounds
Wry neck
Tingling in fingers and arms
Tingling in legs and arms
Pins and needles
Numbness in fingers or toes
Paralysis

7. Locomotor System

Pains in muscles (state where)
Pains in joints (state where)
Stiffness in joints
Contractures (or restricted movements) in joints
Rheumatisms
Weakness
Back pain
General aches
Tenderness or soreness

8. Eye

Double vision
Itchy or painful eyes
Blindness (including night)
Increased sensitivity to light

9. Ear, Nose and Throat

Ringing in ears
Increased sensitivity to noise
Loss of hearing
Dry mouth
Lump in throat
Persistent or frequent sore throat
Persistent cough

10. Skin

Rashes
Itching
Burning sensation
Heavy sweating or perspiration

11. Psychological State

Depression or low mood
Irritability
Paranoia
Suicidal thoughts
Guilty feelings
Repeated fears
Phobia
Confusion or jumbled ideas
Persistent anxiety
Panic attacks
Flashbacks
Jumpiness or easily startled
Feeling distant or cut off from others
Feeling disorientated
Terror

Restlessness
Avoidance of social contact
Changes in personality

12. Sleep Problems

Difficulty in sleeping
Early morning waking
Nightmares
Dreams of war

13. Other Features

Raised temperature of unknown origin
Fevers
Swollen glands (state where)
Loss of appetite
Changes in weight: losses gains
Self-inflicted injury

14. Medical Investigations

The results of any medical examinations and tests (particularly if they show negative physical findings).

15. Medication

III. PERSONAL REPORTS

1. Explanations offered by servicemen for their condition:

2. Explanations and diagnoses of medical officers:

3. Military record of serviceman (including conduct and any charges):